Universidad Autónoma de Yucatán
Facultad de Ciencias Antropológicas
Centro de Información Científica
"Dr. Alfredo Barrera Vásquez"

# The New Catalog of Maya Hieroglyphs

VOLUME ONE

The Civilization of the American Indian Series

Universidad Autónoma de Yucatán
Facultad de Ciencias Antropológicas
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"Dr. Alfredo Barrera Vásquez"

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## VOLUME ONE

## *The Classic Period Inscriptions*

Martha J. Macri
Matthew G. Looper
Grapheme drawings by Matthew G. Looper

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## PIEDRAS LABRADAS

Perdidos en la jungla
varios milenios
de historia,
y olvidados por el hombre
brillantes milenios
de victoria.
Los Mayas y los glifos,
uno sólo
como padres e hijos
midiendo el presente
en los ojos bobachones
del turista
que junto a la estela
manosea en Tikal
un glifo redondo
que a los curiosos
enseña los dientes
como diciendo:
"Después de dos mil años,
caminante,
aquí seguimos de pie
vigilantes
entre las sedas
de las telarañas
del tiempo."

Victor Montejo

## SCULPTED STONES

Lost in the jungle—
several millennia
of history,
and forgotten by men—
shining millennia
of victory.
The Maya and their glyphs
stand as one
like fathers and sons
measuring the present
in the easy-going eyes
of the tourist
who stands by a stele
in Tikal stroking
a round glyph
which bares its teeth
to the onlookers
as if saying:
"After two thousand years,
traveler,
we're still on our feet
vigilant
among the silken
cobwebs
of time."

Translated by Victor Perera, from *Sculpted Stones*, by Victor Montejo (Curbstone Press 1995). Reprinted with the permission of Curbstone Press. Distributed by Consortium.

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# *Acknowledgments*

This volume is a reference summary of research by hundreds of students of the Maya script. It owes its existence, first of all, to the Maya artists and scholars who created the script and to those who for hundreds of years used the script to record their history and culture. We have tried to give an accurate account of their achievement. Ultimately it is their world we seek to understand.

This study is absolutely dependent upon the photographers and artists who recorded the texts from which this research is drawn, those who have risked comfort and often safety to make visible the carvings that time and weather have done their best to erase. This list includes hundreds of field-workers of the nineteenth and twentieth centuries, from Alfred Maudslay, transporting box camera and molds on muleback through the jungle, to Ruth Krochock, chasing wasps away from a text on the Temple of the Four Lintels at Chichén Itzá. Each of them has his or her own stories to tell. Many scholars have brought the field of Maya epigraphy to its current state. The reader will find their names in the reference sections for each of the signs. Decipherment of the script is not complete, but the field has reached a state of maturity in which arguments about gross identifications are being replaced by discussions concerning finer points of textual analysis.

The idea of a completely new way of organizing a sign list was originally conceived by Martha Macri in 1982. At that time she considered various taxonomies, first grouping main signs of J. Eric S. Thompson's *A Catalog of Maya Hieroglyphs* (1962) according to their graphic form. Since then this classification of Maya *graphemes* (the smallest distinctive elements), first applied to the Maya script by Yuri V. Knorozov (1963), has progressed through various incarnations, resulting in the current volume. During the course of the Maya Hieroglyphic Database Project, several research assistants have made valuable contributions to the categorization of signs and to the collection of bibliographical references. Michael Evans, James Brooks, and Circe Sturm were present at the beginning of the project for early attempts at categorization of graphemes by form. James Brooks worked with Macri for several years refining the subcategories and coding the inscriptions of Palenque as a test of the system. Barbara MacLeod and Ruth Krochock helped with differentiating graphemes that Thompson had grouped together and pointed out new readings. Thomas Tolles and Sydnee Lippman assisted with scanning and preparing the images. Heidi Altman and Sarah Shuler edited and reviewed an earlier version of this catalog.

In 1996 Looper joined the Maya Hieroglyphic Database Project. His co-authorship of the *New Catalog* includes the addition of those signs discovered since Thompson's *Catalog,* a reexamination of referenced literature, refinement of the classification system, contribution of additional references, and new drawings of each grapheme. More recently, Gabrielle Vail, co-principal investigator with Macri on the codical texts, has contributed valuable observations on the relationships between certain signs occurring in both the Classic

monumental texts and the Maya codices. Macri and Vail are currently preparing a companion volume containing graphemes from the screenfold books.

The authors intend that this grapheme list will serve as a resource for scholars and students of the Maya script. We have attempted to present accurately the combined knowledge of the most reliable scholars in Maya epigraphy. We wish to express our gratitude and appreciation to all who have contributed to the enterprise of recovering this unique script, lost as a result of the European conquest of the Maya region. We would like to thank Janis Indrikis and Donald Hales for making available to us a photocopy of Eric Thompson's gray cards used in the compilation of Thompson (1962).

The research for this volume has been made possible by the National Endowment for the Humanities, grants RT 21365-92, RT21608-94, and PA22844-96; the National Science Foundation, grants SBR-9710961 and BCS-9905357; and the Native American Language Center, Department of Native American Studies, University of California, Davis.

# The New Catalog of Maya Hieroglyphs

VOLUME ONE

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# Introduction

## THE MAYA SCRIPT

This work is the first of two volumes describing the graphemes (the distinctive signs) of the Maya script. The present volume contains the graphemes found in texts from the Classic period, approximately 150–900 C.E. The principal media include carved stone monuments, stucco wall panels, wooden lintels, carved and painted pottery, murals, and small objects of jadeite, shell, bone, and wood. No bark paper books are known to survive from this period, although they are mentioned in hieroglyphic texts and depicted in scenes on pottery. The second volume of the *New Catalog* (in preparation) describes the graphemes found in the four Maya codices. These Maya books date from later periods and represent graphic and linguistic styles that differ from the script of the Classic period.

This two-volume catalog is an integral component of the Maya Hieroglyphic Database, expected to be available on-line by 2004. The catalog is only a sign list. The database itself must be consulted for the transcription and coding of the texts. The database can also be used to generate concordances of signs, words, and phrases in the texts and to sort these lists by period, site, region, or any of the coded information. For example, it can be used to show the earliest and latest dated examples of a particular sign; or it can generate a list of signs ordered by the dates of the texts, showing possible changes in the form and usage of a grapheme over time. The list can also be ordered by region, showing the spatial distribution of a sign.

Some of the signs listed in the *New Catalog* signify words. Others represent syllables that make no reference to meaning but can be combined with other signs to spell words. Consequently, the only words listed here are those represented by a single sign. Words spelled with multiple signs can be found in the database by searching in one or more of the coded fields (transcription, Mayan gloss, English, semantic domain, grapheme codes, etc.). A full accounting of all words known from the Maya texts will be generated from the Maya Hieroglyphic Database and published in a lexicon (now in preparation). In sum, this catalog is not intended as a comprehensive accounting of the Maya writing system, since it does not treat segments of the script larger than the individual grapheme. Issues of morphology and syntax are more properly included in a discussion of full texts. Even the topic of spelling conventions is here dealt with only in a cursory manner. Our goals are to present all known signs that occur in the script, to arrange them in a logical fashion, to summarize earlier scholars' research, and to identify readings for which there is general acceptance among epigraphers.

We expect that this volume will be of most interest to those who are trying to learn about the Maya script. We also hope that our colleagues in Maya studies will find this compendium a useful tool. We have tried to make this catalog as free from unnecessary jargon as possible and thus accessible to a wide audience, including those who study visual images and semiotics from other iconographic and script traditions.

## The History of Maya Writing

Writing has a long history in Mesoamerica, beginning at least as early as the Middle Formative period (1000–400 B.C.E.). Owing to variable climatic conditions, the only texts to survive from this early period appear on carved monuments or incised portable jade objects, although manuscript forms must have preceded these. Early examples of pictorial images arranged in sequential patterns suggest that Mesoamerican scripts originated from pictographic notation (Justeson 1986). John Justeson and Peter Mathews (1990) suggest that the Maya system was adapted directly from the iconography of early jade celts. In our view, however, it seems more likely that the earliest examples of iconography and writing were recorded on perishable material, of which no examples have survived. Given the time depth of Mesoamerica as a cultural and linguistic area (Campbell and Kaufman 1976; Campbell et al. 1986; Kirchhoff 1943), the process of development from pictographs to word-signs probably occurred within a multiethnic milieu, rather than being the product of a single culture or speech community.

Olmec-style carvings of the Early and Middle Formative periods are characterized by a complex iconographic system (Joralemon 1971, 1976). Many researchers believe that writing developed from the iconography of Olmec style relief sculpture (Prem 1971, 1973). There is, however, little evidence for a script among the peoples practicing the Olmec style. La Venta Monument 13 is sometimes cited as an example of a script on an Olmec-style monument (figure 1; Joralemon 1971). Here an image of a footprint is carved on one side of a profile figure and a vertical column of three isolated signs on the other. In the words of Jacques Soustelle (1984:169), "it is difficult to reject the evidence that these four signs belong to a system of writing." Nevertheless, given the lack of any other examples, the case for writing within the Olmec sphere remains inconclusive.

A stronger argument can be made for the existence of early forms of writing during the Late Formative period (400 B.C.E.–150 C.E.). According to some archaeologists, Zapotec peoples of Oaxaca developed the earliest Mesoamerican writing system, which first appears at San José Mogote during the Rosario phase, about 700–500 B.C.E. (Flannery and Marcus 1983:55). Elaborated during the Late Formative period, Zapotec inscriptions consist of references to dates in the 260-day calendar, while later texts take the form of brief clauses, including names, dates, and events (Marcus 1983). A second early script, called variously the Epi-Olmec, La Mojarra, Tuxtla, or Isthmian script, also appears in the Late Formative period. It is known from four artifacts from the Gulf Coast and the Grijalva River drainage: La Mojarra Stela 1, the Tuxtla Statuette, a sherd from Chiapa de Corzo, and an inscribed mask (Justeson and Kaufman 1993; Macri and Stark 1993; Méluzin 1995). It also may have been recorded on early monuments from Tres Zapotes and other sites in the Veracruz region. The texts are believed to represent a language in the Mixe-Zoquean family (Justeson et al. 1985; Justeson and Kaufman 1993; Lowe 1977). The examples of the Epi-Olmec script are much longer than any earlier texts. The Tuxtla Statuette is inscribed with seventy glyphs and records a date of 162 C.E., while La Mojarra Stela 1 is one of the longest Mesoamerican inscriptions known, having over five hundred glyphs. It features two long count dates—counts of days from the beginning of the current era—equivalent to 143 and 156 C.E.

The Maya script described in this volume appears simultaneously with the Zapotec script, during the Late Formative period. By about 400 B.C.E., at the same time that an elaborate Maya iconographic system was being developed in the northern Maya lowlands, the Guatemalan highlands, and the Pacific piedmont, early monumental texts make their debut. An example is El Portón Monument 1, excavated at a site in the Samala valley and dated to about 400 B.C.E. (Sharer and Sedat 1987:89). Other early monumental inscriptions occur at the Pacific piedmont site of Abaj Takalik. Abaj Takalik Stela 2 features a long count date in the eighth b'ak'tun (354 B.C.E.–41 C.E.), while Stela 5 has two dates in the early ninth b'ak'tun, the latter of which corresponds to 126 C.E. (Graham et al. 1978:103–4). Archaeologists still do not agree on the language

Fig. 1. La Venta Monument 13.

spoken by the creators of these texts. While it is possible that monuments from at least some sites, such as Abaj Takalik, record a Mayan language (Stuart 1995:19), other scholars have suggested the presence of Mixe-Zoquean languages on the Pacific slope (Justeson et al. 1985; Kaufman 1976).

In the northern Maya lowlands, one of the earliest inscribed Maya monuments, El Mirador Stela 2, dates to the Late Formative period, estimated at 300 B.C.E.–150 C.E. (Hansen 1991). Such widely scattered monumental inscriptions during this period suggest the intellectual ferment and widespread interethnic contacts that fostered the development of the Maya script. Further, while the historical relationship of the Maya script to the Epi-Olmec and Zapotec scripts is not well understood, these early examples suggest that a linear developmental sequence, with Zapotec as the mother script, is not justified. Certain distinct correspondences between Epi-Olmec and Maya systems, such as long count notation, imply a close historical relationship (see also Justeson 1986; Justeson et al. 1985). The incised text on the Late Formative Kaminaljuyú Monument 10 includes signs with similarities to both Maya and Epi-Olmec scripts (figure 2; Macri 1991b). While it is possible that both of these scripts derive from a single proto-script (Justeson 1986), or that one derives from the other, it may be that all three systems developed simultaneously in the context of intercultural exchange through diplomatic and trade networks (see Stuart 1995:17).

The Maya script endured far longer than any other system. In fact, it was still being used in northern Yucatán in the sixteenth century. Colonial Spanish authorities actively suppressed it, however, so that by the eighteenth century there is no record of its use. Its geographic range encompassed the Petén region of Guatemala, all of Belize, the Yucatán Peninsula, and parts of Chiapas, El Salvador, and Honduras. Among Mesoamerican scripts, the Maya system has by far the largest corpus, is the most successfully deciphered, and most precisely records the sound of spoken language. Table 1 outlines the basic development of the Maya script during key chronological periods.

## The Languages of the Maya Script

Over thirty Mayan languages either are spoken by contemporary Maya people or are known from colonial documentation (figure 3). Terrence Kaufman (1976:106) estimates that proto-Mayan, the ancestor of these languages, was spoken in the Cuchumatán highlands of western Guatemala as early as 2200 B.C.E. Historical

Fig. 2. Kaminaljuyú Monument 10. Drawing by Federico Fahsen.

linguistics shows that the two families that have proven most relevant to the decipherment of the hieroglyphic texts, Yukatekan and Ch'olan, belong to two distinct subgroups. The Yukatekan subgroup is believed to have been one of the earliest to separate from the proto-Mayan core. Yukatekan languages, which include contemporary Yukatek, Mopan, Itzaj, and Lakantun, are quite similar to one another and constitute a single family. Ch'olan languages (Ch'ol, Ch'orti', Ch'olti', and Chontal) are a separate branch of the Mayan family and are closely related to Tzeltal and Tzotzil of the Chiapas highlands and somewhat more distantly related to the Q'anjob'alan languages of Chiapas and western Guatemala. During several periods of intense interaction, Ch'olan languages borrowed significant grammatical features from Yukatekan, including some person markers and many lexical items. Likewise, Yukatekan has been influenced by Ch'olan languages, although to a lesser degree. Because Ch'olan languages are closely related to Tzeltal and Tzotzil, it is possible to distinguish features that are genetically inherited (shared with Tzeltal and Tzotzil) from those that have been borrowed from Yukatekan or that result from innovation.

The linguistic features that are most relevant to understanding the significance of individual glyphs are phonology (the distinctive sounds), morphology (words and grammatical particles), and the lexical inventory of Yukatekan and Ch'olan. Both families have similar consonant inventories that include the following phonemes: *p, t, k, ', p', b', t', k', x, tz, ch, tz', ch', j, h, m, n, l, w, y.* The liquids *r* and *l* occur as allophones (phonetic variants of a single phoneme). A contrast between the velar fricative, *j,* and the glottal fricative, *h,*

TABLE 1
Major Periods of Maya History

| PERIOD | | EXTANT TEXTS |
|---|---|---|
| Middle Formative | 1000–400 B.C.E. | portable objects (invention of Maya script) |
| Late Formative | 400 B.C.E.–150 C.E. | stone monuments (spread of early Maya script) |
| Early Classic | 150–550 C.E. | monuments, portable objects, etc. (Classic Maya script) |
| Late Classic | 550–900 C.E. | monuments, portable objects, etc. |
| Early Postclassic | 900–1200 C.E. | few stone monuments, Grolier Codex? |
| Late Postclassic | 1200–1700 C.E. | Paris, Dresden, and Madrid Codices, colonial manuscripts |

can be reconstructed for both Yukatekan and Ch'olan families. Other phonemes such as *f* and *d*, as well as contrasts between *r* and *l*, occur in words borrowed from Spanish.

Even though languages in both Yukatekan and Ch'olan subgroups have similar consonant inventories, certain correspondences among cognate (related) words reflect regular phonetic changes over time. For example, some words with *t* in Ch'olan correspond to words with *ch* in Yukatekan (from proto-Mayan *$t^{\prime}$), and some with *k* in Yukatekan correspond to words with *ch* in Ch'olan (from proto-Mayan **k*). For example, proto-Mayan **t'ee'* 'tree' is *te'* in Ch'olan and *che'* in Yukatekan, and **kaan* 'snake' is *kàan* in Yukatekan and *chan* in Ch'olan.

The vowels of Yukatekan and Ch'olan languages include *i*, *e*, *a*, *o*, *u*, and the mid-central vowel *ä*. As syllable nuclei in Lakantun, Mopan, and Itzaj, vowels may be short (V), long (VV), or glottalized (V'V). Additionally, in Mopan, vowels may be followed by *h* (Vh). The vowel *ä* contrasts in length only in Lakantun. Yukatek is the only Yukatekan language in which *ä* does not occur as a distinct phoneme. In Yukatek, vowels occur as neutral, *a;* low tone, *àa;* high tone, *áa;* or glottalized, *a'a*. Ch'olan languages do not distinguish vowel length. Eastern Ch'olan, which includes Ch'orti' and Ch'olti', does not have *ä*. Vowels in Ch'olan may be either short (V), glottalized (V'V), or followed by *h* (Vh). A linguistic analysis of the Maya script shows that the shared phonemic inventories of both Yukatekan and Ch'olan languages are represented. One apparent exception is the contrast between the velar and glottal fricatives, *j* and *h*, which can be reconstructed for both proto-Yukatekan and proto-Ch'olan.

Phonetic and morphological evidence suggests that most of the Classic period inscriptions record a Ch'olan language, rather than Yukatekan. Evidence of a Ch'olan pronunciation is widespread and includes such spellings as **chi-hi** for *chih* 'deer' (*kéeh* in Yukatekan), **ni-chi** for *nich* 'flower' (*nik* in Yukatekan), and **yo-to-ti** for *yotot* 'house' (*yotoch* in Yukatekan) (figure 4; Houston et al. 2000:327–37). In fact, Stephen Houston, John Robertson, and David Stuart (2000) propose that the inscriptions record an Eastern Ch'olan language that functioned as a "prestige language" in the Classic period lowlands (and from which modern Ch'orti' descends). This identification does not preclude historical influences on the script from other languages and dialects, however (Justeson et al. 1985; Macri 1991a). Yukatekan spellings occur in the inscriptions of Palenque and several other sites, especially in northwest Yucatán (Bricker 1986:76–83; Krochock 1998; Lacadena and Wichmann 1999; Stuart 2000b). One example of the cueing of a Yukatekan pronunciation is the **ka** phonetic complement on the serpent head found in the emblem glyph of Calakmul and the name of the Palenque ruler K'inich Kan B'alam II (figure 5). This sign signals a reading of 'snake' as Yukatekan *kàan* rather than Ch'olan *chan*. In this instance, the *kàan* spelling may reflect an archaic pronunciation of a proper name and does not necessarily establish Yukatekan as the language of the texts in which it is found.

Among the morphological aspects that point to Ch'olan as the language of the Classic Maya script, the presence of the verbal suffix *–wan* remains the strongest evidence (MacLeod 1984, 1987a:16; Mathews and

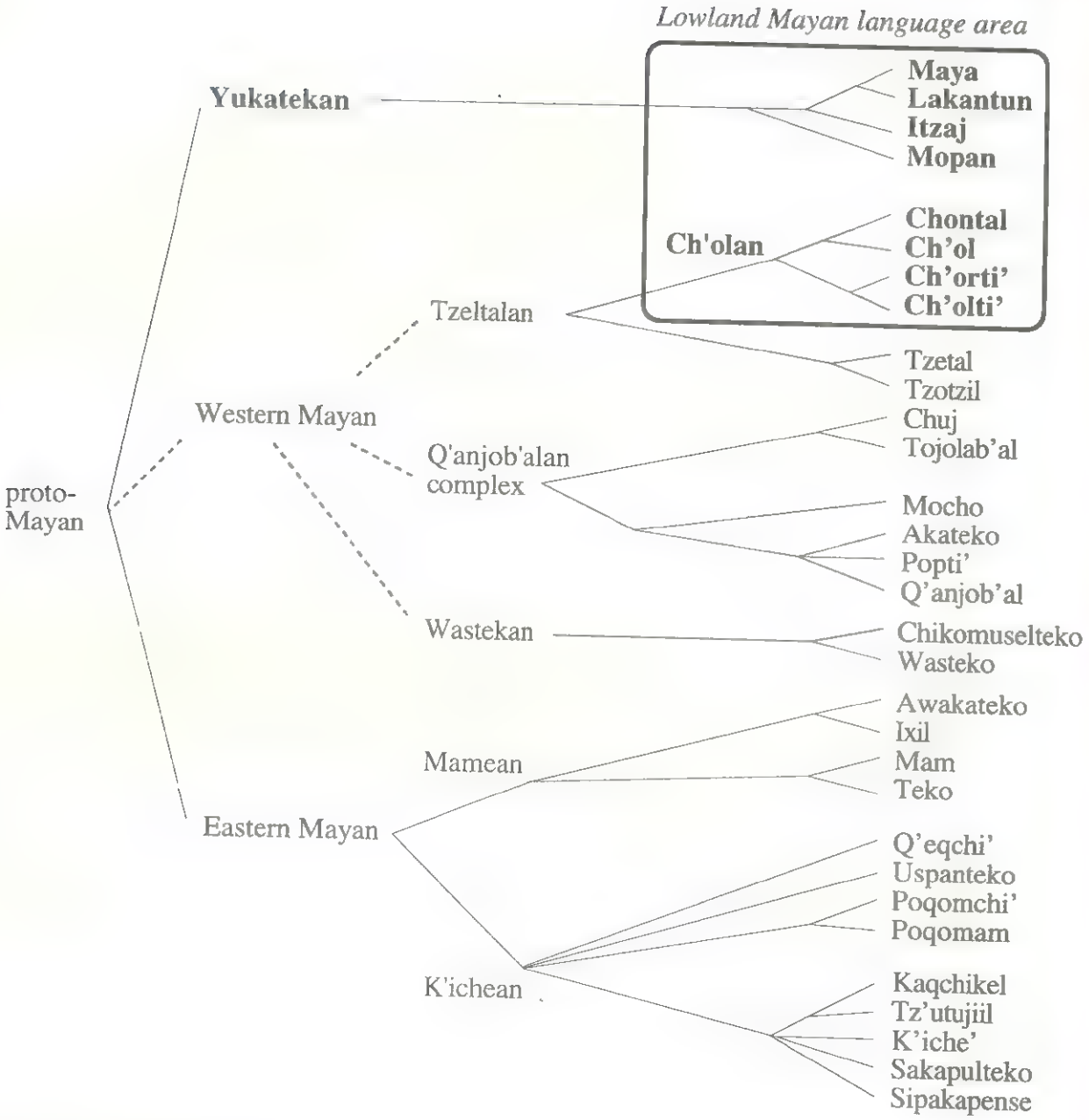



Fig. 3. The Mayan language family.

Justeson 1984:231; Ringle 1985:158). This exclusively Ch'olan suffix appears mainly in the context of accession expressions and is widely distributed throughout the Maya lowlands, even appearing in the northwest Yucatán (García and Lacadena 1990:164). Other verbal suffixes have been cited as indicating one language affiliation or another, but without consensus (Bricker 1986; Houston et al. 2000:325; MacLeod 1987a).

The language recorded in the glyphic texts should not be confused with local vernaculars. Within some local contexts, elites may have spoken a different language or dialect from the general population. Nor can it be assumed that written texts precisely represent the speech of any local population. Borrowings between Ch'olan and Yukatekan indicate that many communities over the course of the Classic period contained

Fig. 4. Compounds reflecting Ch'olan pronunciation: a, **chi-hi** (*chih*), after Robicsek and Hales (1981:191); b, **ni-chi** (*nich*), Tortuguero Mon. 6 H1; c, **yo-to-ti** (*yotot*), Palenque Tablet of the Foliated Cross F2.

speakers of more than one language. In light of the complex relationships between the Classic script and reconstructed languages, it may be appropriate to consider the script a grapholect (a transdialectal script) (Macri 1991a:272; see also Justeson 1986:453; Ong 1982:8, 106–8). In this interpretation, many of the grammatical and phonetic features characteristic of the script represent the simplified common features of diverse languages and dialects. Further investigation will surely cast the linguistics of Maya writing into a sharper focus.

## Decipherment of the Script

Rediscovery of the Maya script began at the end of the nineteenth century and continues today. Europeans and North Americans led the way in the initial phases of decipherment. Today, however, a growing number of epigraphers are from Latin America. These include Maya scholars, who bring their cultural experience and linguistic knowledge to bear on the decipherment and analysis of hieroglyphic texts. Michael Coe (1992) and George Stuart (1992) provide detailed histories of decipherment. Calendrical data were first successfully deciphered in the late nineteenth century (e.g., Forstemann 1904; Goodman 1897). Paul Schellhas (1904 [1897]) correlated images in the codices with certain name glyphs. Most of the progress in the first half of the twentieth century continued to be largely limited to astronomical tables, calendrical texts, and the correlation between the Gregorian and Maya calendars. Thompson's *Maya Hieroglyphic Writing: An Introduction* (1950) summarized what was known of the script at mid-century.

Phoneticism (the notion that the script represented spoken language and that at least some signs represented sound disassociated from meaning) was a controversy from the earliest days of decipherment. It was first argued by Cyrus Thomas (1892, 1893) and defended by Benjamin Whorf (1933, 1942), who considered the script to be either syllabic or alphabetic. Convincing arguments for syllabic signs were not presented, however, until the work of the Russian scholar Yuri Knorozov (1952, 1953, 1955, 1956, 1958, 1963, 1965, 1967, 1968). In the United States, David Kelley (1962a, 1962c, 1976), Floyd Lounsbury (1984), and Coe (1973) supported Knorozov's ideas. Nevertheless, several prominent scholars, including Thompson (1953a, 1953b, 1959) and Tatiana Proskouriakoff, resolutely resisted the notion of abstract phonetic signs in the Maya script. Thomas Barthel (1958) also doubted the validity of syllabic readings and offered sound criticism of Knorozov's work, pointing out that his exclusive reliance on colonial Yukatekan sources made it impossible to extrapolate readings to Classic period contexts. While many of Knorozov's early syllabic readings were correct, his subsequent publications included many morphemic (logographic) readings that cannot be supported. Despite the controversy engendered by Knorozov's work, momentum favoring phoneticism began to build (Kelley 1962a, 1962c, 1976). Linda Schele (1979b:15–20) expanded on the arguments of Knorozov, demonstrating the substitutability of phonetic readings for both the codices and Classic period inscriptions

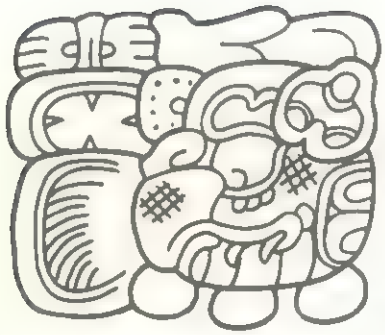


Fig. 5. *K'inich kàan b'alam,* a compound reflecting Yukatekan pronunciation, Palenque Palace Tablet M12.

(see also Houston 1988). The controversy was publicly resolved at the conference on phoneticism in Maya writing that took place at the State University of New York at Albany in 1979 (Justeson and Campbell 1984). A few years later, David Stuart published the article "Ten Phonetic Syllables" (1987b), a work that remains one of the best models for the methodology of decipherment.

The content of Classic inscriptions was another topic of debate throughout much of the twentieth century. The earliest explorers and students of the Maya culture believed that the monuments recorded historical events, as an early statement by Sylvanus Morley suggests:

> While admitting that the inscriptions may, and probably do, contain such astronomical matter as Doctor Brinton and Mr. Bowditch have suggested, the writer believes nevertheless that fundamentally they are historical; that the monuments upon which they are presented were erected and inscribed on or about the dates they severally record; and finally, that the great majority of these dates are those of contemporaneous events, and as such pertain to the subject matter of history. (Morley 1915:33)

By the mid-1940s, however, his opinion had changed: "The Maya inscriptions treat primarily of chronology, astronomy, and religious matters. . . . They are so completely impersonal that it is unlikely that the name glyphs of specific men were ever recorded upon the monuments" (Morley and Brainerd [1946] 1956:229). This interpretation is consistent with that of Thompson (1950:63-65), who emphasized the ritual nature of the texts and rejected the notion that they were biographical. Several important analyses of the 1950s and 1960s, however, forced a reconsideration. The first breakthrough was Heinrich Berlin's (1958) identification of emblem glyphs, signs with a prescribed set of affixes and a variable main sign that are associated with individual sites. This was followed by several other studies in which he associated patterns of names with dates through structural analyses of Palenque inscriptions (Berlin 1959, 1963, 1965, 1968). Barthel (1968) and later Joyce Marcus (1976) applied these discoveries by examining the political implications of emblem glyphs. Peter Mathews (1991) tabulated the emblem glyphs from thirty-five sites and summarized efforts to understand their significance. Stuart and Houston (1994) suggested that some emblem glyphs might also refer to geographic locations within a given political unit. Today these compounds are considered to be of critical importance in interpreting Classic Maya politics.

Simultaneous with the discovery of emblem glyphs was the disclosure of the biographical content of many Maya texts. In a revolutionary paper on the inscriptions of Piedras Negras, Proskouriakoff (1960) identified major event verbs we now recognize as 'birth', 'accession', and 'death', as well as the names of protagonists. She followed this with a two-part study of the history of rulers of Yaxchilán (Proskouriakoff 1963, 1964). Kelley, another pioneer in the field of historical documentation, developed a ruler list for Quiriguá (1962b) and found the name of K'ak'upakal, an ethnohistorically attested personage, in the inscriptions of

Chichén Itzá (1968b). The 1970s and 1980s witnessed a flurry of activity, inspired by the work of these scholars. Mathews and Schele (1974) prepared a ruler list for the site of Palenque, and Christopher Jones (1977) discovered parentage statements for a sequence of three rulers at Tikal. Houston and Mathews (1985) outlined a dynastic sequence of Dos Pilas. In a series of three articles, Michael Closs (1984a, 1985, 1989) examined the history of Naranjo. Mathews established a dynastic sequence for Bonampak (1980) and reconstructed an extensive history of Yaxchilán (1988). Both the general study of Linda Schele and David Freidel (1990) and a volume edited by T. Patrick Culbert (1991) summarize and evaluate the work of these and many other researchers. More recently, textual histories are being presented as part of integrated archaeological approaches: for example, Houston's study of Dos Pilas (1993), William Fash and David Stuart's presentation of recent work at Copán (Fash 1991a, 1991b; Fash and Stuart 1991; Stuart 1992), Krochock's dissertation on Chichén Itzá (1998), and Richard Adams's monograph on Río Azul (1999). As a consequence of the accumulation of historical information, the nature of the political relationships between sites is being reexamined (Grube and Martin 2000; Martin 1996; Martin and Grube 1995, 2000; Schele, Grube, and Martin 1998).

Astronomy, a field of inquiry of early Mayanists, is still of major interest. Anthony Aveni (1980), Victoria Bricker and Harvey Bricker (1998), Barbara Tedlock (1999), and Susan Milbrath (1999) summarize current knowledge of astronomy in Maya texts. Some astronomical information is recorded explicitly, such as the age of the moon and the number of days in a month in the initial series dates that begin many monumental texts. Most interpretations, however, are inferred from matching dates or intervals between dates with significant astronomical events or periods. Lunar and solar eclipses, the lunar sidereal period, solstices, heliacal risings of Venus, the first stationary point of Jupiter, and conjunctions of planets are among the phenomena that the ancient Mayas related to the historical events they recorded. It is likely that certain events were deliberately planned to coincide with astronomical phenomena.

While the subject matter of most of the historical and astronomical texts is now understood, much work remains to approximate accurate linguistic transcription and translation of the texts. The *New Catalog* is designed to assist in these efforts by providing a list of all signs known from the Classic period, together with extensive bibliographic references that document the history of decipherment for each grapheme as well as relevant lexical data from Mayan languages.

## CLASSIFICATION OF GRAPHEMES

### Previous Lists and Catalogs

The *New Catalog* has a long and distinguished list of antecedents. Beginning in the nineteenth century, numerous scholars have attempted to facilitate access to Maya glyphs by ordering or grouping signs by various criteria, frequently assigning them identifying numbers. It is useful to document the most significant of these lists, highlighting the importance of each in its historical context. Each of the following catalogs or lists was an attempt to document and interpret the script from a different perspective and sometimes using a different corpus. Many were hampered by limited sources for inscriptions. In the late nineteenth century, few monumental inscriptions were available for study; therefore, the earlier lists focused on the signs found in the newly rediscovered codices. Incorporation of glyphs found in monumental inscriptions has been gradual, beginning in the early twentieth century, after the appearance of Maudslay's drawings of monuments from southern lowland sites (Maudslay 1889–1902). Beginning in the 1960s and continuing to the present, a number of projects and individual researchers have produced collections of line drawings of inscribed texts. The most important of these documents is the *Corpus of Maya Hieroglyphic Inscriptions* (1975), directed by Ian Graham and published by the Peabody Museum of Harvard University. More recently, Justin Kerr has

recorded inscribed Maya vases with the technique of roll-out photography and is now publishing selected photographs (Kerr 1989, 1990, 1992, 2000; Kerr and Kerr 1994, 1997). With the increase in the corpus size and improved accessibility of texts, the need arises for an updated accounting of the signs. Before presenting this new sign list, we offer observations on some of those that have come before.

*Brasseur de Bourbourg (1869–1870)*

In this earliest systematic study of the Maya script, Charles Brasseur de Bourbourg prepared a catalog and table of glyphs. His sources include the codices, the glyphs appearing in Landa's *Relación* (Tozzer 1941), and a selection of Classic-period signs from Palenque. This study is remarkable not only for its pioneering nature but also because it recognized correspondences between glyphs taken from these diverse sources.

*Rosny (1883)*

Compared to Brasseur's work, Léon de Rosny's *Vocabulaire de l'écriture hiératique yucatèque* is quite limited. Examples are drawn exclusively from the codices and are sorted into lists of days, months, numbers, figurative signs, and sign groups. The signs are numbered in a continuous sequence from 1 to 242; however, many times variants of the same sign have different numbers. Although the numbering system has little value, Rosny's list is useful for his interpretation of signs, (French) translations, and sources for decipherments, including Landa, Brasseur, Rosny, and Thomas.

*Schellhas (1904) [1897]*

Schellhas's list of deity name glyphs identifies nearly the entire set of subjects in the sentences of the codices. The deities are assigned alphabetical names that for the most part are still standard in the field. Further, the name glyphs are associated with their respective attributive glyphs. Most of the names are compounds, though a few are single graphemes (e.g., God C [AMC in this catalog]). Schellhas also includes name glyphs for what he terms "mythological animals."

*Tozzer and Allen (1910)*

The study by Alfred Tozzer and G. Allen (1910), like that of Schellhas, was not intended as a comprehensive catalog but simply as a list of Maya glyphs used to name specific animals. Like Brasseur's work, it incorporates examples from both the codices and the monuments and attempts to relate them to iconography. The information is organized into an extensive list of animals by phylum/class: mollusca, insecta, myriapoda, and mammalia.

*Gates (1931)*

A landmark and influential study of the Maya script, William Gates's catalog was the first attempt at a systematic concordance of graphemes. As such, it can be considered the earliest conceptual precursor of the *New Catalog*. The work emphasizes the codices but includes some monumental signs. The most significant contribution of this work is its listing of signs with multiple examples and contexts. Gates's list is also the first attempt at standardizing glyphic style and thus prefigures Thompson's catalog (1962).

Gates's catalog is numbered in a logical manner and is discontinuous, allowing for expansion. Signs numbered 1 to 497 are grouped as day signs, month signs, other calendrical signs, cardinal points, numerals, colors, face signs, quasi-facial forms, animal figures, and conventional forms, which include pictographic objects and eclipse and constellation bands. What Gates terms "minor" elements are numbered 600

to 757. He did not assign numbers to the head variant signs and otherwise made no attempt to account for numbers in the script.

*Knorozov (1955)*

Published in a bilingual (Russian and Spanish) edition, the earliest of three major glyph lists by Knorozov includes only signs found in the codices. The list is given in three parts; the first (numbered 1 to 150) includes individual signs, followed by a list of two hundred "words" (compound signs) and a list of thirty phrases. The ordering of the signs within these groups is not logical. Nevertheless, Knorozov gives extensive information for most of them, including an identification of the object represented, a syllabic or ideographic reading, and a gloss of the ideographic reading. This study made extensive use of the Motul dictionary and Brasseur's dictionary (1872). Contextual information (codex and page number) is occasionally provided.

*Zimmermann (1956)*

Like Knorozov (1955), Günter Zimmermann's catalog of glyphs includes only codical signs. Zimmermann, however, took a more sophisticated approach to both sign numbering and analysis of graphemes. Rather than sorting signs by semantic value as had been common in previous studies, he arranged signs according to form, separating small signs (affixes, numbered 1 to 91) from large or main signs (numbered 100 to 1377). The main signs are further grouped into series of human heads and body parts (numbers 100–169), animal heads and body parts (700–763), and "conventional ornamental" signs ("Konventionell-ornamentale Zeichen"; 1300–1377). Zimmermann is the first to use Roman numerals to represent numbers. He also offers examples of contexts with complete transcriptions. For some signs, explanatory text, including identifications, is given (e.g. 39, 66–69, 89). Equivalents for signs recorded by Landa are also listed (Zimmermann 1956:15–17).

*Evreinov, Kosarev, and Ustinov (1961)*

This concordance of codical signs inaugurated the computer age in the field of Maya epigraphy. Numbered discontinuously 1 to 577, the list includes complete computer-generated contextual information. The codical texts are arranged by showing each frame (usually four glyphs with an illustration) on a single page accompanied by a grid diagram with proposed readings.

*Thompson (1962)*

From its publication forty years ago, Thompson's (1962) *Catalog of Maya Hieroglyphs* has been without question the most comprehensive list of Maya graphemes, including both codical and monumental signs. Most of the more recent lists are merely refinements of his system, adding a few signs to his list or reassigning others. Thompson's goal was to account for every recorded glyph. By painstakingly assembling identical glyphs on cards, he created a file of graphemes, which were then arranged in four groups. Like Zimmermann's catalog, Thompson's groups are based on gross formal characteristics, with affixes (numbers 1–370) followed by main signs (numbers 501–856). Portraits (human/supernatural faces) follow as a distinct series (numbers 1000–1087), and finally a group of unidentified "indistinct" main signs (numbers 1300–1347). For many signs, Thompson gave readings (e.g., "Imix" for T501) or descriptions/nicknames (e.g., "fire fist" for T672). Like Zimmermann, Thompson used Roman numerals to encode numbers and discontinuous numbered sets. Inspired by Gates, Thompson's drawings are standardized. The catalog includes a concordance with Zimmermann's sign list (Thompson 1962:399–403).

One of the most useful aspects of Thompson's catalog is the system of identifying contexts. Included are lists of all the known occurrences of each main sign listed with site, monument, and coordinates and

the catalog number of any signs joined to it. The affixes are cross-referenced to the numbers of the main signs with which they occur. The lack of such contextual information for the "portrait" series (numbers 1000–1087) is an unfortunate deficiency.

The years since the *Catalog*'s publication have been the most productive in the history of Maya decipherment. The contribution of the Thompson *Catalog* to this effort is seldom acknowledged. Ironically, however, its success has contributed to its present inadequacy for use in an accurate transcription of Maya texts. We note the following deficiencies:

- The ordering of signs is for the most part random, thus failing to explicitly associate signs related graphically, syllabically, or logographically (for example, signs depicting hands are scattered throughout the *Catalog*).
- Some signs with a single number actually encompass several distinct signs (for example, the variants T609a and T609b are two graphemes, XHA 'throne' and XHB 'book').
- Some signs are conflations of two or more graphemes (for examples, see appendix 5).
- Some signs are variations of a single sign (for example, our grapheme HT8 includes T644 and T772).
- The distinction between main signs and affixes is often unwarranted, contrasts between square and elongated shapes many times having more to do with artistic considerations and scribal conventions than with any essential characteristic of a grapheme (for example, our grapheme 2G2 includes T93, T603, and T634).
- Numerical head variants are transcribed by Roman numerals, leaving them outside the format of the other glyph designations.
- Many signs were unknown to Thompson (see the discussion above).

### *Kelley (1962c)*

Kelley (1962c) combines features of earlier catalogs, including both graphemes and "glyph groups" organized by categories: animals, objects, days, directions and colors, offerings, locations, god names and titles, months, numbers, temporal periods, astronomical glyphs, Glyph X of the lunar series, Glyph G, haab' patrons, verbs, syllabic spellings, "count group" prefixes, plants, emblem glyphs, and personal names and titles. Kelley includes a list of glyphs by Thompson numbers with identifications, syllabic and logographic readings, and translations with credits for decipherment. This work is valuable in that it includes both codical and monumental signs and incorporates the interpretations of Knorozov (1955).

### *Rendón and Spescha (1965)*

Juan Rendón and Amalia Spescha's criteria for classification of Maya graphemes constitute a significant intellectual contribution. Several of their key concepts have been used in the creation of the grapheme classification schema in this volume. Their system groups variants together and juxtaposes similar signs, thereby unifying the classification. In addition, their catalog maintains no separation of main signs from affixes. They recognized that a nonarbitrary naming system would facilitate computer searches and that classificatory groups would provide flexibility when adding new signs to established categories. Finally, their system affords the possibility of transcribing glyphs that are only partially legible. Although their catalog is incomplete, many of their innovative notions have been incorporated in this catalog.

### *Knorozov (1967)*

Knorozov (1967), an English translation of Knorozov (1963), is an expansion and refinement of Knorozov (1955). It includes both codical and monumental signs. The sign groupings are complicated, owing to the

segregation of codical and monumental signs as small (1–100, 415–46), small oval (101–10), and large (111–414, 447–540). The "large" sign category includes large ovals (111–253, 447–69), elongated ovals (254–57, 470, 471), figure ovals (258–97, 472–506), dotted ovals (298–309, 515, 516), and branched ovals (310–17).

For each number, Knorozov identifies the object represented and provides previous references with proposed Old Yukatek readings, Nahuatl comparisons, glosses in Russian (translated into English by Sophie Coe), and context information. The study also includes charts of numbers, numerical head variants and various other calendrical signs, comparison of days with Aztec day names, personal names, objects, actions, and offerings as well as a concordance with Gates and Zimmermann numbers.

*Kelley (1976)*

Kelley (1976) includes the first extensive discussion of verbal morphology and structural analysis of codical and monumental texts as well as linguistic reconstructions of proto-Mayan forms by Terrence Kaufman given at the end of each chapter. Although it was not meant to be a catalog per se, Kelley included several charts of signs with Thompson numbers and proposed values and decipherments, many informed by the work of Knorozov (1955, 1967). These interpretations are indexed by Thompson number (Kelley 1976:331–34). The first syllabic grid of Maya graphemes is also presented (Kelley 1976:182–83). Finally, the volume includes a useful and thorough history of decipherment and discussion of previous lists (Kelley 1976:289–91).

*Smith-Stark and Ringle (1981)*

Thomas Smith-Stark and William Ringle (1981) designed a computerized database coding all the Maya texts by Thompson numbers. They pointed out limitations of Thompson's system of numbering glyphs and incorporated some important revisions into their database. Three new series were appended to Thompson's list, including a 400 series (new affixes), a 900 series (new main signs), and an 1100 series (new head variants). To date, they have encoded a significant portion of the corpus, with each record giving the Thompson numbers for the glyphs in each glyph block. There is also an identifying phrase with each record. The first publication to come from this project is a concordance of the texts of Palenque (see below, Ringle and Smith-Stark 1996).

*Schele (1982a)*

One of the most valuable reference works in the field of Maya epigraphy is Schele's (1982a) catalog of verbs. All of the known event phrases are listed in 133 charts, grouped according to main sign and related affix pattern. With each entry Schele provides a drawing of the glyph blocks in the event phrase. The noun phrases associated with the events, dedicatory dates of the monuments, and dates of the events are glossed but not shown. The entries are cross-referenced with indices of Thompson numbers, affix patterns, dates, and clauses on each monumental text listed by site.

*Mathews (1984) and Justeson (1984)*

The conference on phoneticism in the Maya script at the State University of New York at Albany in 1979 generated two summary appendices published in 1984. The first is a syllabic chart, created by the participants on a blackboard and redrawn by Mathews (1984). The other is a summary of proposed readings listed by Thompson number (Justeson 1984), in which nine contributors are credited by name (referenced by their initials). In several instances signs with the same Thompson number are divided into two or more sets. In

many cases equivalencies between two or more signs are indicated. Many of these readings had never before been published, so no citations to published works are provided. These appendices document the diverse opinions about a large portion of the corpus at a crucial point in the history of decipherment.

*Bricker (1986)*

In her *Grammar of Mayan Hieroglyphs*, Bricker (1986:166–67) describes a computerized database she created for the purposes of syntactic analysis. It included more than one thousand clauses from fifty-one sites and the Dresden Codex. The glyphs are recorded using Thompson numbers, a "functional" classification (date, verb, emblem glyph, etc.), and their position in the clause. This volume includes an index organized by Thompson numbers with proposed readings.

*Kurbjuhn (1989)*

Kornelia Kurbjuhn's catalog (1989) is an updating of Justeson (1984). It includes new decipherments proposed during the 1980s as well as proposed readings solicited directly from epigraphers. The opinions of a total of twenty-eight epigraphers are included. Two affixes and seventeen main signs are appended to the Thompson (1962) series: 371, 372, 857–70, and 1088–90. There are also three added unnumbered affixes inserted between 370 and 371. A lack of adequate referencing and citation and uncritical reliance on the catalogs by Thompson (1962) and Zimmermann (1956) underscore the limited value of this work. It represents an improvement over Justeson (1984), however, in that drawings are included for each catalog number, as well as for Thompson's unidentified main signs (numbers 1300–1347).

*Davoust (1995)*

Michel Davoust (1995) provides a general resource on the Maya script. It includes a catalog with images from Thompson (1962), sometimes with variants added, and an indication of whether the sign is present in the monumental texts and/or codices. There is a descriptive phrase for each sign, followed by logographic value, translation, the language(s) for logographic values, and, finally, syllabic value. Sometimes sources for readings are given. Additions to Thompson (1962) follow those of Kurbjuhn (1989), with a few exceptions. Only one affix (371) is added to Thompson's list, but it does not correspond to Kurbjuhn's number 371. In addition, Davoust (1995) adds one portrait glyph (1091). The value of the catalog is diminished by the inclusion of unsupported decipherments and several errors.

*Ringle and Smith-Stark (1996)*

The first product of a comprehensive database project begun in the 1980s, Ringle and Smith-Stark (1996) includes a complete listing of the hieroglyphic texts from Palenque that were known at the time and a concordance that gives full contexts of these signs encoded in Thompson numbers. Like several previous studies, the catalog is based on a reworking and extension of Thompson (1962), but in this publication the reclassifications are more extensive. Their catalog of glyph elements does not include readings for the graphemes.

*Grube (1989, 1990a)*

The most original feature of Nikolai Grube's dissertation (1989, published in 1990a), a general study of the Maya script, is an appendix that gives the earliest and latest known occurrences of each grapheme. Grube also identified which of Thompson's signs he considered allographic variations. Included are 46 new abstract

signs and 132 portrait signs, 59 of which are renumbered from Thompson (1962) or Zimmermann (1956). The portrait heads are grouped into several categories: numeral head variants, period head variants, day and month signs, secondary series heads, supernatural beings, skulls, and miscellaneous portraits. In a summary article, Grube (1994c) includes a discussion of the temporal distribution of graphemes. He shows syllabic charts from 9.5.0.0.0 (534 C.E.) and 9.14.0.0.0 (711 C.E.) as well as a chart of signs used syllabically after 9.11.0.0.0 (652 C.E.). Grube identifies two periods of rapid change in the script and notes, as did Kelley (1976:167), that a core of phonetic signs has in fact remained quite stable from the earliest attestations and the newly invented signs tended to be logographic rather than syllabic.

*Knorozov (1999)*

A posthumous summary of the most recent work of Knorozov, the *Compendio Xcaret de la escritura jeroglífica maya descifrada por Yuri V. Knórosov,* is a three-volume set edited by Patricia Rodríguez Ochoa, Edgar Gómez Marín, and Myriam Cerda González. For the most part, the ordering of signs follows Thompson, with little effort to combine obviously equivalent affixes and main signs. Logographic and syllabic values are given, many of which are the same as those proposed by Knorozov in his earliest publications. No references to other works are cited in the body of the *Compendio.*

The *New Catalog*

This volume lists signs from the Classic period, including variants found on ceramics as well as variants from the inscriptions of northwestern Yucatán dating to the Terminal Classic (800–900 C.E.) and Early Postclassic (900–1200 C.E.) periods. Signs found exclusively in the later Maya books can be found in *The New Catalog of Maya Hieroglyphs, Volume 2: The Codices* by Macri and Vail (currently in preparation). The development of these volumes is necessitated by the increase in the number of known signs and the dramatic progress in decipherment since the publication of Thompson's *A Catalog of Maya Hieroglyphs* (1962). The development of the *New Catalog* was given added impetus by the Maya Hieroglyphic Database Project. This project involves the coding of the entire corpus of Maya inscriptions by logographic and syllabic values, Mayan and English glosses, semantic categories, grammatical and morphological features, date of event, date of text, notes, and bibliographic references. Each record is linked to a low-resolution line drawing of the block and to a second image showing the glyph block within a larger context. The graphics component of the database is essential for rigorous comparison. The Maya Hieroglyphic Database can be used to create a nearly infinite number of comparisons and concordances with refined chronological, geographic, and stylistic parameters.

A reclassification of the graphemes as radical as the one we propose, as well as the addition of so many signs, necessitates a new set of illustrations for the graphemes. Thompson's list, previously the most complete, employed stylized images. Sometimes the standard form was actually created from what we now recognize as two separate graphemes. At other times, essential diagnostic details were omitted. In the case of frequently occurring signs, regularization often imposed inappropriate esthetic judgments. For rare signs it is simply impossible to create an idealized form. The drawings of each grapheme in the present catalog are based on actual hieroglyphic texts from the full range of media, locations, and periods and are thus representative of the variation seen in actual Maya texts. They do not favor any single style; nor do they suggest an artificial standard. The images are larger than those published by Thompson, thus facilitating inclusion of important detail.

In the analysis of any script, the first objective is to identify distinctive signs. Some scripts, such as Egyptian, exhibit remarkable graphic uniformity; that is, at least within a single text, all examples of a sign are virtually identical. Other scripts, such as Arabic, have special forms of signs depending upon whether

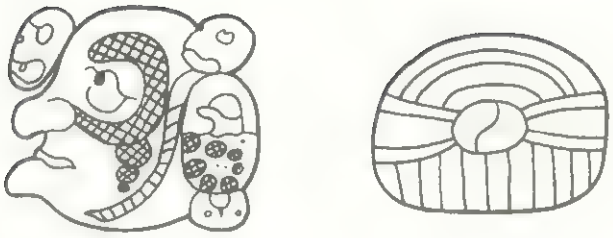
they occur initially, medially, or finally within a word. The Maya script exhibits an unusual degree of graphic variation of individual signs, sometimes even within a single text, so the task of deciding which signs are distinct graphemes and which are variations has been an arduous one. Some variations are elaborations of graphically more simple signs. Others are abbreviated forms of more complex signs. In this sign list we have included over 200 variations. We consider such variants to be equivalent in meaning, having the same logographic and/or syllabic values.

Often variants do not freely substitute for one another. An example is the anthropomorphic **way** glyph (PE4), which is actually a head variant of the Tikal emblem glyph main sign (intermediate forms are known) (HB1; figure 6). Despite the fact that the **way** head variant can be used in the Tikal emblem glyph, the Tikal main sign cannot be used to represent the word **way**. This requires the identification of two distinct graphemes. Most of the texts available for study are quite repetitive, representing a limited number of formal genres: the political events and parentage statements on public monuments, ownership on name-tagged items, or calendrical, astronomical, and ritual information. Presumably, if a large enough corpus were available, we would have examples of such substitutions.

The system of coding described below has been developed to facilitate assigning unique designations to graphemes for transcription, for cross-referencing, and to aid computer searches for graphemes with similar features. The earliest researchers referred to individual glyphs by picturing them. Later it became common to refer to them by naming the site, monument, and coordinates. Once Thompson's catalog (1962) was published, the signs were referred to by his numbers, commonly called Thompson numbers or T-numbers. As discussed above, several authors have added to Thompson's original list of numbered signs (Davoust 1995; Kurbjuhn 1989; Ringle and Smith-Stark 1996; Smith-Stark and Ringle 1981). Since the added signs do not necessarily correspond from one author to the next, we have only used numbers appearing in Thompson (1962). Some of his "unidentified main sign series" have been added to the *New Catalog*, though we have not referred to them with the 1300-series numbers.

The three-digit coding used in this volume was not developed with the specific intention that the codes would be used as *names* for the graphemes in scholarly texts in the same way that Thompson's numbers have been used, although this is certainly a viable application. Mayan epigraphers, even by the mid-1980s, had for the most part abandoned the Thompson codes as names and had begun referring to graphemes by phonetic value or by the site, monument, and coordinates of specific examples. Today many otherwise competent epigraphers know only a few Thompson numbers by memory. Our intention, however, has been to develop a system of identifying distinct graphemes for computerized searches of the corpus of inscriptions. Identifying the discrete graphemes of a script requires a way to refer to each grapheme individually. This can be a largely random system of numbering or lettering or an ordering of signs into related groups or sequences based on a variety of criteria. Our choice, in light of recent developments in decipherment, has been to create a three-digit coding system in which the first two digits provide information about the graphic characteristics of the sign. Three digits were chosen as the minimum number necessary to distinguish several hundred graphemes. The letter and number combinations are designed so that, except for the bar/dot numerals one through nineteen (001–019), all codes have at least one letter, insuring that there can be no confusion with Thompson numbers.

This system of code assignments, based primarily on form rather than on phonetic or semantic characteristics, has a number of advantages. The classification is expandable, and newly discovered graphemes can easily be integrated into the system by adding them at the end of each two-digit category. A further advantage of this system is that signs that are only partially legible can be coded to account for the information that is available. Partial information can be represented by using the appropriate first or first and second digits followed by zeros. Using Thompson numbers, one would have to list possible signs or make a guess at an identification. In this system three zeros (000) indicate an unreadable glyph.



a b

Fig. 6 Variants of the Tikal emblem glyph: a. PE4; b. HB1

The total number of numbered signs in Thompson (1962) is 861 (370 affixes, 355 main signs, 88 portraits, 48 unidentified main signs). The total number of graphemes in this catalog is 673 (with variants, the total is 886 signs shown). The difference between the two catalogs is much greater than these summations suggest. In addition to eliminating duplicate signs, we have added about 250 graphemes for which there is no Thompson number. This is a significant addition, nearly one-third over the original total. Of Thompson's *Catalog* we identify fewer than 400 distinct graphemes used during the Classic period. Many of his numbered signs are actually variants, as is the case with the "water group" AMC. We have also not included Thompson's signs that are conflations of two graphemes. These are listed in appendix 5. Table 2 contrasts the statistics for distinct graphemes in these two catalogs. Thompson's signs include numerous variants as well as signs that occur only in the codices.

The *New Catalog* frequently provides more than one image per grapheme. These *allographs* are phonetically equivalent variants and depict the same object or part of the same object. Although uniformity in size and shape of graphemes is highly valued in most scripts, Maya scribes relished variation. They created allographs in two ways: by reducing graphemes to the minimal component(s) necessary for identification and by elaborating graphemes, often adding features of a human or animal face to an otherwise abstract sign. Our task, in the face of such variation, has been to determine which variants are allographs and which constitute distinct graphemes. For each grapheme we have had to decide whether the abstract variants or the personified or otherwise elaborated variants should be taken as primary. We have usually chosen the most commonly occurring allograph or the simplest form as the basis for categorization. These signs appear in the catalog with the number *1* in front of the picture description. Subsequent variants follow, numbered accordingly. One grapheme is shown with nine variants, one with six variants, three with five variants, nine with four variants, and the rest with two or three variants or with a single example. We have included rare variants of a sign when they might not be easily recognizable. In addition to facial variants, most of the numerical and calendrical glyphs and a few noncalendrical glyphs can be represented in full-figure form. These depict animal or human bodies elaborated with identifying marks on their face, limbs, or costumes. This volume does not include images of full-figure variants.

Allographic variation is irrelevant to the reading of a text. Although it amounts to no more than differences in lettering style or font, it can provide insight into the period or place of origin of a given text. In labeling allographs we considered adding an additional lowercase letter to provide unique designations. One choice is simply to add letters (*a, b, c,* etc.), and another is to add meaningful letters (e.g., *d* for duplicated, *e* elaborated or expanded, *p* personified, *r* reduced, *s* simplified, etc.). In the interests of simplicity and because the potential for variation is so great, our choice has been to preserve the three-digit label. If referring to a particular variant is necessary, it can be referred to by the number preceding the picture descriptions, or, preferably, it can be described by one of the above adjectives; by naming it by site, monument, and coordinate; or by providing an illustration.

TABLE 2
Comparison of Graphemes in the *New Catalog* (*Volume 1*) with Numbered Signs in Thompson (1962)

| NEW CATALOG: VOL. 1 (CLASSIC PERIOD) | | | THOMPSON (1962) (CLASSIC PERIOD & CODICES) | |
|---|---|---|---|---|
| | 101 | *1, 2, 3* | 370 | *affixes* |
| | 420 | *A, B, H, M, X, Y, Z* | 355 | *main signs* |
| | 145 | *P, S* | 88 | *portraits* |
| | ø | | 48 | unidentified signs |
| | 7 | *0 (numbers)* | ø | |
| Total | 673 | | 861 | |

*The First Digit*

The first digit encodes thirteen distinct categories based on formal characteristics of the primary variant (see table 3). The letters *A, B, H, M, P,* and *S* designate respectively animals, birds, body parts, hands, persons, and supernatural beings. Many animal and bird signs and nearly all persons and supernatural beings are represented as left-facing profile heads. The letter *A* designates the first letter of signs depicting fauna (except for birds and humans). Usually these signs are profile heads, though some are whole animals or parts of animals. This category does not include human or supernatural heads with animal features. Grapheme codes beginning with *B* include birds (usually depicted as profile heads) and parts of birds, such as wings, feathers, and feet. *H* designates human body parts, except for heads and hands. The Maya script is unusual among hieroglyphic scripts in the large number of hand signs it employs. Many of the hands hold objects. Some phonetic readings are based on words for 'hand', 'handful', and 'five'. For many hand shapes, the origin of the value is unknown. The faces that have human characteristics, designated by *P,* have round or oval eyes and human noses. Supernatural faces, signs beginning with *S,* are profile heads distinguished by square eyes and other exaggerated or mixed human and animal characteristics. Animal features represented include those of snakes, jaguars, birds, and fish. Both human and animal skulls are included in the supernatural category since it is often impossible to determine whether a skull is that of an animal, a human, or a supernatural.

The sets *X, Y,* and *Z* designate any square signs not included in previous sets: *X* is for square symmetrical signs in smooth cartouches, *Y* is for square asymmetrical signs inside smooth cartouches, and *Z* is for square signs with irregular cartouches, including those composed of multiple elements. Some of these signs depict recognizable objects, often plants or fruit, but for many of them the original referent is unknown.

The numbers *1, 2,* and *3* introduce elongated signs of one, two, or three or more elements, not included in any of the above categories. These categories are not equivalent to Thompson's "affix" category. He noted, among other characteristics, that when an affix is joined to a square sign, some affixes keep the same side toward a main sign. In other words, true affixes can be rotated without resulting in a change in their meaning. The same cannot be said for any of the square signs, several of which we have identified as distinctive signs when rotated 180° (see discussion below). This characteristic does argue for a conceptual category of affixes that contrasts with "main signs." Our 1, 2, and 3 codes, however, signify only that these graphemes are elongated in shape.

If a sign is composed of two identical elements it begins with 22; if composed of three identical elements it begins with 33. If it has more than three elements it begins with 3. Labels beginning with two numbers always have a letter for the third digit in order to avoid any confusion with Thompson numbers. 0 followed by 00 (000) signifies that evidence of a glyph is visible but it is unidentifiable. 0 followed by two numbers indicates a bar/dot numeral of 01 through 19 (e.g. 001, 002). Head variants for the numbers 1–13 have individual codes based on graphic characteristics (figure 7). The letters *I* and *O,* easily confused with the numbers *1* and *0* respectively, are not used in any coding capacity.

TABLE 3
Major Categories of Sign Forms

| | |
|---|---|
| A | Animals (fauna except birds and humans) |
| B | Birds (birds) |
| H | Body parts (body parts, except heads and hands) |
| M | Hands (human and capuchin monkey) |
| P | Human faces (faces that have human characteristics) |
| S | Supernatural faces (faces with square eyes and other exaggerated or mixed human and animal characteristics) |
| X | Square symmetrical signs |
| Y | Square asymmetrical signs |
| Z | Square signs with irregular silhouettes |
| 0 | (followed by two numbers) bar/dot numerals |
| 0 | (followed by 00) unreadable glyph |
| 1 | Elongated signs, single element |
| 2 | Elongated signs, two elements |
| 3 | Elongated signs, three or more elements |

The categories in this coding system are hierarchical. First, signs with hands are assigned to the H category regardless of any other features they may include. The A–S categories have precedence over X, Y, Z and 1, 2, 3. Thus, a jawbone in a square cartouche is given the letter *H* (human) rather than *Y* (asymmetrical square signs). Square and elongated categories include only those signs that do not fit into the A–S categories.

*The Second Digit*

The second letter assigns the glyph to a subcategory based on form. Bilingual English and Spanish mnemonics cue the subcategories shown in table 4. For each subcategory, the numbers of graphemes and the total number of examples are shown. For some, a brief description of the category is given. Zero in the second digit following a letter or number signifies an unreadable sign that can be identified as belonging to one of the twelve major categories. For example, A00 would designate an unidentifiable animal head.

*The Third Digit*

The third digit is arbitrary, indicating sequencing of graphemes sometimes roughly in order of frequency or according to similarity of form. The signs are ordered by a number, 1–9, continuing with letters if there are more than nine signs in a category. For those signs in the categories beginning with 1, 2, or 3, the third digit is always a letter. Zero in the third digit signifies a sign that can only be partially identified as belonging to a two-digit category; for example, MR0 would designate an image of a right hand that is missing crucial diagnostic elements.

## FORMS, VALUES, AND FUNCTIONS OF MAYA GRAPHEMES

The following section summarizes the functional, formal, and semantic aspects of Maya graphemes, informed by the classification in the *New Catalog*. Typologically, the Maya script is logo-syllabic in that some of the signs are logographs, representing words in Mayan languages, while others are syllabic signs that represent various consonant plus vowel (CV) combinations. The process of decipherment continues.

PC1 number 1; haab' patron: K'ayab'; one of three variable elements in Glyph C

MZ8 number 2

PT3 number 3

SN4 number 4; period: 1 day, k'in; haab' patron: Yaxk'in/Yaxk'in

SN1 number 4; day 20: Ajaw/Ajwal; haab' patron: Yaxk'in/Yaxk'in

PT5 number 5

PH6 number 6

ST7 number 7; day 16: Kib'/Chib'in; haab' patron: Wo; one of three variable elements in Glyph C

PE8 number 8

PT9 number 9

SC1 number 10; day 06: Kimi/Tox; one of three variable elements in Glyph C

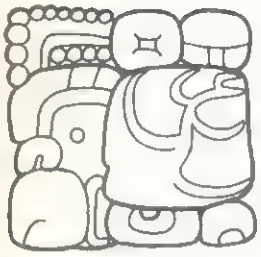
PM6 number 11

PE1 number 11; day 17: Kab'an/Tzanab'; haab' patron: Sek/Kasew

PT2 number 12

SS5 number 13

Fig. 7. Head variants for numbers 1–13.



...tónoma de Yucatán
...ntropología
...ación Científica
...a Vásquez"

Fig. 8. Quiriguá emblem glyph, Quiriguá Stela A D9.

Nearly one-third of the 673 graphemes in the *New Catalog* have a proposed syllabic value, and about half have a proposed logographic value (10 percent have both). Thus, two-thirds of all the graphemes have either a proposed logographic or syllabic reading. Only about a third of the graphemes listed here have no generally accepted logographic or phonetic reading. Of these, many can be identified by their function, such as verbs (e.g., 'bless', 'dedicate'), calendrical signs (e.g., haab' patron, completion sign, glyph Y), animals (e.g., rabbit), objects (e.g., shell, dart, planet Mars), toponyms (e.g., main sign of Seibal emblem glyph), or personal names and titles (e.g., GIII). This leaves few signs completely undeciphered.

In the epigraphic literature, the term "sign" is occasionally used to refer to a grapheme. "Hieroglyph" and "glyph" are less exact terms in that they can refer to an individual grapheme or to a group of signs that together represent a single word or phrase (cf. Bricker 1986:1). For example, the sign for 'white' **säk** (3M1) is a single grapheme. In contrast, an emblem glyph typically combines three or more graphemes, including **k'uh(ul)/ch'uh(ul)** (AMC), **ajaw** (2M1), and a variable element that itself can be composed of one or more signs (figure 8).

Individual graphemes sometimes appear alone, but more frequently are combined into *glyph blocks*, the graphic units of glyphic texts. The rectangular shape of glyph blocks results from the arrangement of texts into rows and columns, read left to right and top to bottom (see Thomas 1882). This arrangement contrasts with the Epi-Olmec and Zapotec scripts, which are read in single columns. The incised text on Kaminaljuyú Altar 10 is intermediate between the Epi-Olmec and the Maya formats (see figure 2 above; Macri 1991b). Signs are paired in double columns, but the horizontal rows of the double columns are not aligned. In the Maya lowlands the earliest known double-column inscription is the text fragment on El Mirador Stela 2. Several early Maya texts are characterized by less than perfect grids—for example, Tikal Stela 4 (Jones and Satterthwaite 1982:fig. 5) and Calakmul Stela 114 (Pincemin et al. 1998:316). The shorter texts painted and inscribed on ceramic objects are varied in format. Some are written in double columns, like monumental texts, but many are arranged in a single line that wraps around the circumference of vessels. Secondary texts on both pottery and monumental texts, which often give names of figures or record dialogue, are commonly arranged in short single columns or L-shaped texts that read across and then down. A few notable examples of inscriptions are written entirely in mirror image, and the reading order proceeds from right to left.

Within glyph blocks, signs on the top and to the left are read first, central signs next, and signs on the bottom and to the right are read last. Usually, but not always, when there are signs both on the top and to the left or on the bottom and to the right, the one occupying an entire edge is read first for prefixes and last for suffixes. There are a few signs, notably **näl** (2S1) and **ajaw** (2M1), that are positioned above a central sign but were probably pronounced last. The composition of glyph blocks seems to have been motivated graphically as well as linguistically. A block ordinarily includes one or more morphemes, though a morpheme can be spelled across two blocks. A glyph block may, however, include a noun phrase or verb phrase, or even a complete sentence.

The *sign form* of the Maya script is representational in that many of the graphemes are identifiable objects. Some are animals or humans, usually depicting their faces or body parts. For instance, there is an

TABLE 4
Subcategories of Sign Forms

| CODE | SUBCATEGORY | DESCRIPTION |
|---|---|---|
| animals | | |
| AA | aquatic | animals and animal parts associated with water: fish, shells, amphibians |
| AC | snake (*culebra*) | snake heads, bodies, body parts |
| AL | lizard | all reptiles except snakes |
| AM | monkey/Ajaw | complete monkeys, heads, faces, and Ajaw faces |
| AP | dog/rodent (*perro*) | various mammals not included in more specific categories |
| AT | jaguar (*tigre*) | jaguar heads, bodies, and parts |
| AV | deer (*venado*) | deer heads, bodies, and body parts |
| AX | mixed | various mammals with additional elements |
| birds | | |
| BM | mixed | generic and miscellaneous birds and body parts |
| BP | parrot | parrots |
| BT | owl (*tecolote*) | owls and other raptors |
| BV | vulture | vultures |
| human body | | |
| HB | bun | hair bun |
| HE | eye | eyes |
| HH | bone (*hueso*) | bones |
| HJ | jaw | mandibles |
| HM | male genitals | male genitals |
| HT | torso | other body parts: torsos, legs, feet |
| hands | | |
| MB | both | two hands or single digit |
| MR | right | right hands |
| MZ | left (*izquierdo*) | left hands |
| persons | | |
| PC | face (*cara*) | human faces with plain eye |
| PE | decorated eye | human faces with decorated eye |
| PH | hidden eye | human faces with covered eye |
| PM | mouth | human faces with object in or on mouth |
| PT | top | human faces with forehead adornment or object on head |
| PX | mixed | right facing or frontal faces |
| supernaturals | | |
| SB | bird | birds with exaggerated or mixed animal characteristics |
| SC | skull (*calavera*) | human and animal skulls |
| SN | human nose | supernatural beings with human nose |
| SS | supernatural nose | supernatural beings with nonhuman nose |
| ST | jaguar (*tigre*) | supernatural beings with jaguar features |
| square shape, symmetrical | | |
| XD | design | patterned or plain |
| XE | imix type | similar to the day sign for Imix |
| XG | drops (*gotas*) | having one or more circlets |
| XH | horizontal | divided by a horizontal line |
| XQ | quadripartite | divided into four parts |
| XS | spiral | having spirals or curved lines |
| XV | vertical | divided by a vertical line |

TABLE 4 (continued)
Subcategories of Sign Forms

| CODE | SUBCATEGORY | DESCRIPTION |
|---|---|---|
| square shape, asymmetrical | | |
| YG | drops (*gotas*) | having one or more circlets |
| YM | mirror | having mirror markings |
| YS | spiral | having spirals or curved lines |
| irregular square shape or complex | | |
| ZB | bundle | ties or binding |
| ZC | kawak | having a kawak "stone" infix |
| ZD | design | patterned or plain |
| ZE | elbow | occupying adjoining vertical and horizontal sides |
| ZH | horizontal | divided by a horizontal line |
| ZQ | quadripartite | divided into four parts |
| ZS | spiral | having spirals or curved lines |
| ZU | U-shaped | cartouche open on one side |
| ZV | vessel | pottery vessels or baskets |
| ZX | compound | composed of two or more cartouches |
| ZY | notched | having a notch or point on one side |
| ZZ | notched, multiple | having multiple notches |
| numerals | | |
| 00 | numeral | numerals denoted by bars and circles (lines and dots) |
| elongated shape, one element | | |
| 1B | bundle | appearing to be tied or bound |
| 1C | kawak | having a kawak "stone" infix |
| 1G | drops (*gotas*) | having one or more circlets |
| 1M | mirror | having curved "mirror" signs |
| 1S | spiral | having spirals or curved lines |
| elongated shape, two elements | | |
| 22 | 2 | two identical components |
| 2G | drops (*gotas*) | having one or more circlets |
| 2M | mixed | miscellaneous signs with two parts |
| 2S | spiral | having spirals or curved lines |
| elongated shape, three elements | | |
| 32 | 2 | three components, two identical |
| 33 | 3 | three identical components |
| 34 | 4 | four or more components |
| 3M | mixed | miscellaneous signs with three components |

extensive set of hands. A few signs are identifiable objects, such as plants, clothing, vases, or architecture. Many signs are so stylized that their representational significance is not apparent. The relationship of the represented image (visual form) to the value (linguistic form) of the sign is sometimes obvious, but more often obscure. For purposes of decipherment, earlier researchers usually relied on visually motivated readings, but recent epigraphers have discovered new readings more reliably by identifying substitution patterns rather than by attempting to derive a reading from the graphic form of the sign.

The visual and linguistic reference of many logographs is convergent, in that their conventional meanings are roughly similar. For example, a head of a monkey is used to represent the word for 'monkey', *maax*. In this and many other cases, the glyphic sign is often abbreviated without affecting phonetic value. Another

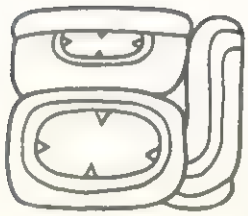


Fig. 9. **Lak'in,** Yaxchilán Lintel 30 F3.

common mode by which form and value are related in the Maya script is the rebus (Justeson and Mathews 1990; Thompson 1944, 1950:46–48). A rebus is the use of an image of an object to represent a word that is homophonous or nearly homophonous with the word corresponding to the depicted object. An example of rebus usage in the Maya script is the glyph for 'east,' read *lak'in,* which is composed of a 'plate' (**lak** ZVB) joined with the 'sun' glyph, **k'in** XQ3 (figure 9; Justeson n d.). Another is the usage of a sign representing a necklace (*uh*) as the third person Set A pronoun *u-* (HE6).

Morphological features represented by logographs include free morphemes (words) and bound morphemes (meaningful elements that can only occur as parts of words). Examples of free morphemes are *b'áalam/b'ahläm* 'jaguar' and *tí'/ti,* a locative preposition. An example of a bound morpheme is *u* 'he/she/it' or 'his/her/its'. Often, epigraphers use the term "phonetic" in contradistinction to "logographic," when in fact all logographs have a phonetic value in that they were pronounced. For example, a picture of a deer probably represented the Yukatekan or Ch'olan word 'deer'. A hypothetical phonetic value can only be confirmed, however, when the sign occurs with syllabic complements or if there are substitutions in equivalent contexts in which the word is spelled with syllabic signs. Many of the logographs in the script have some variation of the typical CVC shape of Maya roots, CVVC, CVhC, CV'C (e.g., **man** or **cháak/chahk**); others represent more complex derived forms (e.g., **b'áalam/b'ahläm** and **ko'haw**). In the body of the *New Catalog,* readings in Mayan languages are provided only when a sign is known to have been used for that word. For example, 'hand' is not a logographic reading for all of the hand signs, even though the objects depicted are obviously hands. From the Classic period there are no known examples of the fish (AA1) used for anything but the sound *ka.* Logographic value is often related to, but frequently not precisely equivalent to, the visual referent of the sign.

*Calendrical signs* constitute a distinct category of logographs. In the Maya script, each of the twenty day-names in the Mesoamerican calendar of 260 days is represented by a unique grapheme. Because the conventional references to these days come from Colonial Yukatek, they may not be the same as the names used in the central or southern lowlands during the Classic period. Data from colonial and contemporary Mayan languages allow for likely reconstructions, but the attested examples do not necessarily reflect ancient pronunciations. Indeed, because day signs never carry syllabic complements (nor were they spelled syllabically), we cannot be certain of their pronunciation. Established logographic and syllabic values for some of the day signs seem to be unrelated to attested names. A list of day signs with logographic and/or syllabic values is given in figure 10.

The Maya period glyphs used in the long count (the count of days from the beginning of this era), the signs for the twenty-day "months," and the glyphs of the supplementary series are composed of both single and multiple graphemes. Some of these graphemes have known logographic and/or syllabic values and occur in noncalendrical contexts. The *New Catalog* lists graphemes only and therefore does not include calendrical glyphs composed of more than one grapheme. Month names, names for lunations, and the Lords of the Night series are more appropriately included in a lexicon.[1]

[1] For recent discussions of glyphic compounds see Coe and Van Stone (2001) and Montgomery (2002).

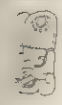
| | Code | Day name (Yukatekan/Ch'olan) | Syllabic value | Logographic value |
|---|---|---|---|---|
| | XE1 | day 01: Imix/Imux | **b'a** | ***b'äh / b'ä; b'ah*** |
|  | SS6 | day 01: Imix/Imux | | ***ha'; oxlajun / uxläjun*** |
| | XQ6 | day 02: Ik'/Ik'; haab' patron: Mak/ Chantemak | | ***ìik' / ik'*** |
| | XQ6 | day 02: Ik'/Ik'; haab' patron: Mak/ Chantemak | | ***ìik' / ik'*** |
| | XH9 | day 03: Ak'b'al/Wotan; haab' patron: Mol/ Mol | | ***áak'äb' / ahk'äb'; àak' / ak'; äk'*** |
| | XH4 | day 04: K'an/K'anan | **wa?** | ***óol / ol*** |
| | XH4 | day 04: K'an/K'anan | **wa?** | ***óol / ol*** |
| | XG4 | day 05: Chikchan/Nachan | **xa** | |
| | ACL | day 05: Chikchan/Nachan | | ***man*** |
| | AC6 | day 05: Chikchan/Nachan; haab' patron: Sak/Sak, haab' patron: Kumk'u/Ohl | **b'i** | ***kàan / chan*** |
| | SC1 | day 06: Kimi/Tox; number (head variant) 10; variable element in Glyph C | | ***lajun / läjun*** |
| | MR7 | day 07: Manik'/Manich' | **chi** | |
| | AV1 | day 07: Manik'/Manich' | **chI** | ***kéeh / chij*** |

Fig. 10a, b, c. Day signs with conventional Yukatekan and Ch'olan names, syllabic and logographic values.

Knorozov (1952, 1953, 1955, 1956, 1958, 1963) introduced the notion of semantic determinatives, believing that the Maya script, like Egyptian hieroglyphics, had signs that confirm a specific reading for a particu ar glyph. For example, all names of gods in Egyptian are followed by a semantic determinative signifying that a god rather than a mortal is the referent. In the Maya script, Schele (1979b:16–17) suggested that a headband occurring on a vulture, human, or animal head indicates that the glyph is to be read **ajaw** 'ruler'. Nevertheless, the use of the headband alone (ZB3) to represent this **ajaw** argues for its interpretation

| | Code | Day name (Yukatekan/Ch'olan) | Syllabic value | Logographic value |
|---|---|---|---|---|
| | ZQD | day 08: Lamat/Lamb'at; haab' patron: Yax/ Yax | | *èek' / ek'* |
| | YG2 | day 09: Muluk/Mul | **u** | *u-* |
| | XG1 | day 09: Muluk/Mul | | *pèet / pet; -péet / -pet* |
| | AP9 | day 09: Muluk/Mul | **b'a** | *b'äh / b'ä; b'ah* |
| | AP5 | day 10: Ok/Ok | | *ok / och; òok / ok; òoch / uch?* |
| | YS5 | day 10: Ok/Ok | | |
| | XS3 | day 11: Chuwen/B'atz' | **cha; se** | |
| | AMJ | day 11: Chuwen/B'atz' | | |
| | SC4 | day 12: Eb'/Eb' | | |
| | XH1 | day 13: B'en/B'in | | |
| | AT7 | day 14: Ix/Ix | | *hix* |
| | SSE | day 15: Men/Men | | |
| | XH6 | day 16: Kib'/Chib'in | | |

as a logograph, not a semantic determinative. We consider the headband and the human, vulture, and animal that contain the headband to be four distinct graphemes (ZB3, PT7, BV1, AX1) (figure 11).

The cartouche for the day sign (ZZ1) may, in fact, have functioned as a semantic determinative during the Classic period. This grapheme indicates that the enclosed sign functions as a day sign rather than representing a syllabic or logographic value. Nevertheless, it is possible that originally the cartouche was read **k'al** 'twenty'. The "inverted ajaw" that is occasionally infixed in the lower part of the cartouche may support

| | Code | Day name (Yukatekan/Ch'olan) | Syllabic value | Logographic value |
|---|---|---|---|---|
| | ST7 | day 16: Kib'/Chib'in; number (head variant) 07; haab' patron: Wo; variable element in Glyph C | | ***wúuk / huk*** |
| | YS1 | day 17: Kab'an/Tzanab'; haab' patron: Sek/Kasew | | ***kàab' / kab'*** |
| | XQ8 | day 18: Etz'nab'/Chab' | | |
| | ZC7 | day 18: Etz'nab'/Chab' | | |
| | ZC1 | day 19: Kawak/Chak | **ku** | ***tùun / tun*** |
| | ZC1 | day 19: Kawak/Chak | **ku** | ***tùun / tun*** |
| | SS1 | day 19: Kawak/Chak | | ***cháak / chahk*** |
| | AM1 | day 20: Ajaw/Ajwal | | ***ahaw / ajaw; nik / nich?*** |
| | PT7 | day 20: Ajaw/Ajwal | | ***ahaw / ajaw*** |
| | BV1 | day 20: Ajaw/Ajwal | | ***ahaw / ajaw*** |
| | AMF | day 20: Ajaw/Ajwal | **u** | ***u-*** |
| | AX1 | day 20: Ajaw/Ajwal | | ***ahaw / ajaw*** |
| | SN1 | day 20: Ajaw/Ajwal; number (head variant) 04; haab' patron: Yaxk'in/Yaxk'in | | ***kän / chän*** |

this hypothesis, possibly serving as a phonetic complement, **la** (figure 12a).[2] In addition, *ti* or *ta* sometimes appears above or to the top left of the day sign (figure 12b). This suggests that the preposition is read after the number, as in the phrase 'eleven Ajaw of the twenty'.

[2] Alternatively, the inverted ajaw may be an iconographic feature indicating the floral derivation of the day sign cartouche. If this is correct the element would have no phonetic significance.

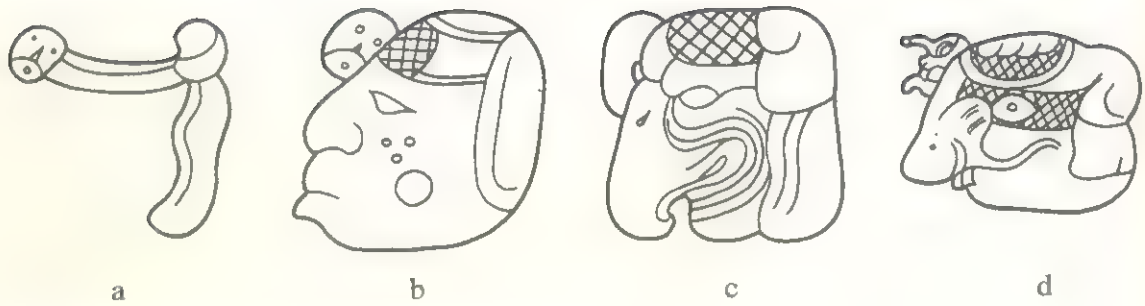



Fig. 11. Graphemes reading **ajaw**: a. ZB3; b. PT7; c. BV1; d. AX1.

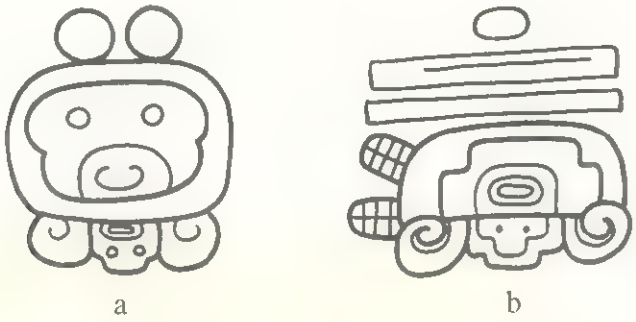



Fig. 12. Examples of the day sign cartouche with possible **la** complements: a Caracol Altar 4; b Tikal Marcador E1

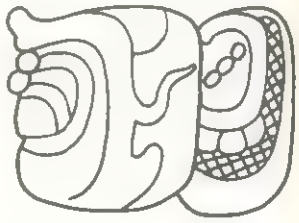


Fig. 13. Double dots indicating the double reading of a grapheme, Piedras Negras Lintel 3 F2.

Another functionally distinctive grapheme is the two small circles (22A) placed at the corner of a larger grapheme to indicate the doubling of the grapheme's reading (Stuart and Houston 1994:46). For example, double dots placed before the **tz'u** syllable indicate a *tz'utz'(u)* reading (figure 13). This sign function relates to the use of 'two' in words for 'repeat' found in many Mayan languages (e.g., Aulie and Aulie 1998:30; Barrera Vásquez 1980:277; Hofling and Tesucún 1997:338). We consider it to constitute a unique category. It is an example of a grapheme that is not read; that is, it has neither syllabic nor logographic value. The two dots simply instruct the reader to repeat a syllable. It is therefore more properly described as a diacritic than as a semantic determinative. There is no other punctuation or sign indicative of reading known from the Maya script.

*Subgraphemic* features are not listed as individual signs. These iconographic elements are important in formal recognition, but they have no logographic or syllabic value. Examples include the IL mark on female

a b c

Fig. 14. Glyphs with subgraphemic features: a. AP9; b. ZC2; c. 1C1.

faces and the circle containing a dot shown frequently on hands/wrists. Graphemes can be used as subgraphemic features, such as the k'an cross (XQ1) in the jog glyph (AP9) or the stone kawak markings on several graphemes, including **witz** (ZC2) and the glyph for flint (1C1) (figure 14).

Nearly a third of the total number of signs signify consonant + vowel syllables. Table 5 is a chart of all of the possible CV combinations in Yukatekan and Ch'olan languages (21 consonants, 5 vowels). About 80 percent of all the possible CV combinations have been documented in the script. Syllables with *i*, *a*, and *u*, those vowels at the extremes of the vowel space (high front, high back, and low), are represented most often. Syllables with *e* and *o*, the mid vowels, are least common. There appears to be no contrast in syllabic signs between *a* and *ä*. At least some syllabic signs have been securely identified for all consonants except *p'* (although there are two candidates for **p'e** that are not universally accepted). Nearly all signs for syllables containing plain stops and affricates have been identified. Sets with glottalized stops and glottalized affricates are the least complete. There may be a contrast between *j* and *h* as **ju/hu**, but this is unusual. In addition, the **ha** syllables do not all freely substitute, suggesting that there may be a hard/soft contrast, but this has not been thoroughly investigated.

## Spelling Conventions

Since the Maya script is a mixed logographic/syllabic script, words may be represented by single logographs, compounds of syllables, or a combination of both types of signs. Sometimes a logograph stands alone to represent a word; at other times a syllabic complement is added to signal or to reinforce a particular reading. Frequently logographs are combined to create derived forms. A word may be spelled entirely by a sequence of CV graphemes. The problem with such a system is that many Mayan words end in a consonant, and roots are typically CVC, CVVC, CVhC, or CV'C in shape, with inflectional and derivational affixes generally (C)V- or -V(C) in form. Knorozov, who possessed a knowledge of Akkadian, Egyptian, and other nonalphabetic scripts, immediately recognized in the Maya script a common convention by which CVC words are spelled with two CV graphemes, the second grapheme representing the same vowel as the first: CV + CV (Knorozov 1958:290). Such *synharmonic* spellings occur in spellings such as *b'akab'* **b'a-ka-b'a** 'ruler' and *nuk* **nu-ku** 'great; large'.

While Knorozov's principle of synharmony holds for some spellings, *disharmony*, in which the second vowel is not the same as the first one ($CV_1 + CV_2$), is also frequent. Scholars have proposed many explanations for this phenomenon, even to the point of using these examples as proof that neither CV values nor synharmony apply to the Maya script (Thompson 1953a, 1963). One explanation is that the second syllabic sign is polyvalent (e.g., **tun-nV** for *tun*) and thus is synharmonic. Or it may be that the variation is random or that some as yet undiscovered predictable pattern will explain the variation. Recently Houston, Robertson,

TABLE 5
CV Combinations for Which Syllabic Signs Have Been Identified

| | i | e | a / ä | o | u | /5 |
|---|---|---|---|---|---|---|
| Plain stops and affricates | | | | | | |
| **p** | • | | • | • | • | 4 |
| **t** | • | • | • | • | • | 5 |
| **tz** | • | | • | | • | 3 |
| **ch** | • | • | • | • | • | 5 |
| **k** | • | • | • | • | • | 5 |
| **'** | • | • | • | • | • | 5 |
| Glottalized stops and affricates | | | | | | |
| **p'** | | • | | | | 1 |
| **b'** | • | • | • | • | • | 5 |
| **t'** | | | | | • | 1 |
| **tz'** | • | | • | | • | 3 |
| **ch'** | | | • | • | | 2 |
| **k'** | • | • | • | • | • | 5 |
| Fricatives | | | | | | |
| **s** | • | • | • | | • | 4 |
| **x** | • | | • | • | | 3 |
| **j** | | | | | • | 1 |
| **h/j** | • | • | • | • | • | 5 |
| Nasals | | | | | | |
| **m** | • | • | • | • | • | 5 |
| **n** | • | • | • | • | • | 5 |
| Liquid and semi-vowels | | | | | | |
| **l** | • | • | • | • | • | 5 |
| **w** | • | | • | • | | 3 |
| **y** | • | • | • | • | • | 5 |
| | 17 | 13 | 18 | 15 | 17 | |

and Stuart (1998) have proposed a different theory to explain disharmony in the Maya script. They suggest that disharmonic spellings indicate a complex vowel in the root (VV, V'[V], or Vh). Thus, *cháak/chahk* is spelled **cha-ki,** instead of **cha-ka.** This rule extends to syllabic complements as well, in which, for example, a **ki** complement is consistently added to the **cháak** logograph. This solution is currently being reviewed and refined by various epigraphers.

It also happens that a few bisyllabic words (CVCVC) are spelled with only two syllabic signs with no indication of the final consonant of the second syllable: for example, **i-tz'i** *itz'in* 'younger brother' (Stuart 1997:6) and possibly **ju-ku** *jukub'* 'canoe' (Looper 1992). An explanation for this phenomenon may be that in rapid speech in both Yukatekan and Ch'olan languages (and other Mayan languages as well) word final or phrase final consonants such as *l, m, n, p,* and *b'* are frequently devoiced and unreleased. The writing system may thus reflect this phonetic feature, utilizing a disharmonic complement or spelling to represent additional elements that may not be fully pronounced during reading (e.g., **tun-ni** for *tunil*).

Some seemingly disharmonic spellings actually indicate morphological variation. In such cases, CV signs can only be interpreted as spelling VC morphemes or "morphosyllables," as termed by Houston, Robertson, and Stuart (2001). Although some epigraphers object strenuously to the suggestion of CV/VC

alternations, there seems to be no other explanation for many spellings. Again, such alternations are found in Akkadian and other known syllabic scripts. The use of morphosyllables is documented at the site of Palenque in expressions incorporating the variable element in the emblem glyph **b'ak,** represented logographically by a bone (HH1), a skull (SCM), or a heron (BM8). In the emblem glyph the variable element is complemented by **la** (AMB), whereas in the Palenque spirit companion title **le** (1SC) follows the **b'ak** logograph (figure 15a, b). A satisfactory morphological explanation for this variation is that **la** is used to spell *–al,* a suffix that derives locations from nouns; here, 'place of the heron(s)' from 'heron.'[3] In the other context, **le** is used for *-el,* a suffix that derives adjectives from nouns. Thus, the entire compound may read 'the spirit companion of the heron place' or 'the Palenque spirit companion'. Another example occurs in the main sign of the emblem glyph of Tikal, which represents a hair bun and reads **mu'ut** (Stuart, in Grube and Martin 2000:74–75). This sign is often suffixed by **la**. As an alternative to interpreting **mu'ut-la** as a disharmonic spelling, it is more likely that **la** here functions as the derivational morpheme *-al* in *mu'utal.* Thus, Tikal may be referenced as 'place of the hair buns/birds' or, using a Mixe-Zoque etymology, 'place of the water pools' (Macri 2001b).

In Palenque texts, the *b'ak* place name is always spelled with a logograph. This contrasts with the **b'ak**, **b'ak-ki,** and **b'a-ki** alternation occurring in 'he of *x* captives' expressions, most of which occur along the Usumacinta and Pasión River drainages, and with the **b'ak**, **b'ak-li**, **b'ak-ki**, **b'a-ki**, and **b'a-ka** spellings of 'bone' found throughout the Maya lowlands (figure 15c). Surely some of these are best interpreted as indicating derivational affixes, such as *-il* or *–al,* rather than as evidence of either disharmonic or synharmonic spellings. The explanation that the **ki** and **li** complements indicate that the root has a complex vowel offered by Houston, Robertson, and Stuart (1998) is uncertain, given that among the contemporary lowland languages only Yukatek and Lakantun retain the proto-Mayan long *aa* in *b'aak.* Itzaj, Mopan, and all Ch'olan languages have a short vowel, *b'ak.*

In the present catalog, we have not created a separate category for morphosyllables, as their value is understood to be inverted from the syllabic value. Morphosyllabic usages are labeled "suffix" in the field "word class."

## Formal Aspects of Graphemes

In addition to their semantic and functional properties, Maya graphemes have distinctive formal characteristics, which changed over time. The design of individual graphemes resulted from the iconographic tradition upon which it was based. The rectilinear format of hieroglyphic writing is related to Middle and Late Formative monumental art traditions, especially architectural facades, which are vertically and horizontally constrained. The rectilinear quality of graphemes was further reinforced by the typical arrangement of texts into paired columns from an early date (see Schele and Miller 1986:pl. 32b). The association of large elements with small elongated elements, seen throughout the entire history of the script, also recalls the formal structure of early Maya pictorial art, such as the elaboration of earflare assemblies. Maya writing continued to develop in tandem with pictorial images, such that there is full iconographic and stylistic integration of the two modes of communication.

By the Late Classic period, grapheme shapes are typically squared, with closed outlines and few projecting forms. In painted texts of the period, a very wide grapheme outline complements fine inner details and emphasizes grapheme integrity (see Coe and Kerr 1997:154). In contrast, many early texts feature signs with irregular silhouettes (Schele and Miller 1986:pls. 9, 10, 22a, 32b). One motivation for this development may have been the prominence of personified glyphs in the Early Classic period. Another may have been the change from incising technique to relief carving. The incising technique typical of early texts allowed artists

[3] For example, Tzeltal *–Vl* adds the meaning of 'place of abundance of objects' as in *tàhal* 'stand of pine' or *ixim<u>al</u>* 'cornfield' (Kaufman 1971:81).

a b c

Fig. 15. Examples of **b'ak** with various affixes: a. **k'uh(ul)-b'ak-la-ajaw-wa** (*k'uhul b'aka! ajaw*), Palenque Temple of the Inscriptions, east panel Q9; b. **b'ak-le-wa-way-la** (*b'akel wayal*), Palenque Tablet of the 96 Glyphs I2; c. **aj-ux-b'ak-ki** (*aj ux b'ak[il?]*), Tamarindito Hieroglyphic Stairway 2 Step 3 G2.

great freedom in outline, in which glyphs were often widely separated. In contrast, later monumental texts were often first laid out with a deeply cut rectilinear grid. As the sculptor worked, probably following a painted pattern, the blocks were further subdivided into smaller rectangular shapes. The result was highly rectilinear in appearance, although sometimes a right handed slant from the lower left to upper right is visible. This slant is perhaps most evident in painted texts, although even painted signs retain a basically rectilinear form. Some examples show that artists used guidelines, analogous to the grid of a monumental inscription, to place the text (see Coe and Kerr 1997:155–56; Reents-Budet 1994:255, pl. 6.23). Even Late Classic incised texts, such as the Palenque Tablet of the 96 Glyphs, have rectilinear graphemes that conform to the grid ideal (figure 16).

The design of most graphemes is generally based on an ideal of balanced asymmetry. This holds for both ovoid forms and faces. The typical orientation of face signs looking to the left counterbalances the movement of the reader's eye toward the right. Because of their broken or indented left side, face signs seem to have a center of gravity on the lower right side. Often an ear, earflare, or other marking emphasizes a grapheme's center of gravity. This uneven weight distribution is also seen in closed oval signs, in which the upper left-hand corner is usually relatively rounded. While few signs are precisely symmetrical, most have internal details regularly distributed throughout the grapheme. For instance, the complexity of the nose, mouth, and forehead on the left side of faces is often balanced by an elaborate earflare on the right. The preponderance of curved and arcing elements within a grapheme, coupled with the slightly rounded shape, often suggests rotational movement. On painted texts, this movement is sometimes enhanced by an evident brushstroke in the outline, beginning at the upper right and proceeding counterclockwise (Coe and Kerr 1997:154). Sometimes the artist leaves the outline incomplete, with a short gap between the initial and final strokes.

The proportions of Maya graphemes vary considerably. Some graphemes have an elongated form, while others are roughly equivalent in height and width. Other signs are composed of aggregates of two or more units of varying sizes. Even the earliest discussions of the Maya script distinguish between main signs and affixes (e.g., Brinton 1895:81). While some graphemes are relatively stable in form, such as 3M2 **ti**, others are remarkably variable. Many signs of diverse shapes are simply variants of each other, produced through processes of elaboration and reduction. A few graphemes alter their proportion through duplication, in which the signs are placed side by side. Examples are **yá'ax/yäx** (ZUJ), on Tortuguero Monument 6 G8, and **ka** (AA1), which is frequently doubled. Some doubled signs are typically arranged in mirror image, such as **sa** (XV4) and **ma** (32A). In the latter, a small loop separates the duplicated units. A similar principle guided

Fig. 16 Palenque Tablet of the 96 Glyphs, detail. Photograph by Merle Greene Robertson, copyright Merle Greene Robertson, 1976.

scribes to render a **nu** sign either as a simple mirror with tassels or as twin mirrors connected by a knot and partially surrounding a large oval sign (3M9). Many graphemes are expanded or contracted to fit a space, such as YM2 **ta** and AL6 **áayin/ahin**. In addition to adjustments in proportion, graphemes may be reduced through suppression of parts. An example is the rendering of MB3 on Quiriguá Stela F, C12 (Looper 1995:fig. 5.2d), with only one arm instead of the usual two.

One of the most distinctive and interesting features of the Maya script that allowed for graphemic variation is personification. We distinguish two kinds of personification. *Substitution personification* occurs when an abstract sign is replaced by a human or animal head, to which it is graphically unrelated. The most common of these are the calendrical glyphs for various periods (b'ak'tun, k'atun, etc.) (figure 17) and the numbers 1 though 19 (see figure 7).[4] *Elaboration personification* involves the transformation of an abstract sign into a face (usually generic human or snake), while retaining graphic features of the original sign. Theoretically, any sign could be personified through elaboration; but in practice, only a limited number of variants are common, mostly the day signs (see figure 10). Examples of noncalendrical personified signs are 1S2, 32K, and ZU1. The most extreme method of elaboration to fill a space is the rendering of a grapheme—usually only a face sign—as a full-figure form (figure 18). Usually a generic humanoid body (usually with supernatural markings) is attached to the glyph. For many of the A-series glyphs (animals), a naturalistic animal body is used, appropriate to the sign. For the b'ak'tun, k'atun, and tun periods (SB1, SB3, and SB4), generic bird bodies with spotted feathers and serpent wings accompany the bird heads, as on Copán Stela D (figure 19).

[4] Head variants for 14–19, and sometimes for 13, are composed of a skeletal jaw added to the head variants for 3–9.

XQ3 1 day, k'in; haab' patron: Yaxk'in/Yaxk'in

SN4 1 day, k'in; number (head variant) 04; haab' patron: Yaxk'in/Yaxk'in

AMK 1 day, k'in

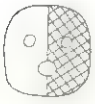
ZU8 1 day, k'in (with 2S2 suffix)

SNA 1 day, k'in (with 33F suffix)

XS1 20 days, winal

AA7 20 days, winal

AM9 20 days, winal


AM2 20 days, winal

XH2 360 days, tun; 365 days, haab'

SB4 360 days, tun; 365 days, haab'; 7,200 days, k'atun

SS8 360 days, tun; 365 days, haab'

SB5 360 days, tun; 365 days, haab'

ZH1 7,200 days, k'atun

ZH1 7,200 days, k'atun

SB3 7,200 days, k'atun

ZC5 144,000 days, b'ak'tun

SB1 144,000 days, b'ak'tun

XH3 144,000 days, b'ak'tun; haab' patron: Sek/Kasew

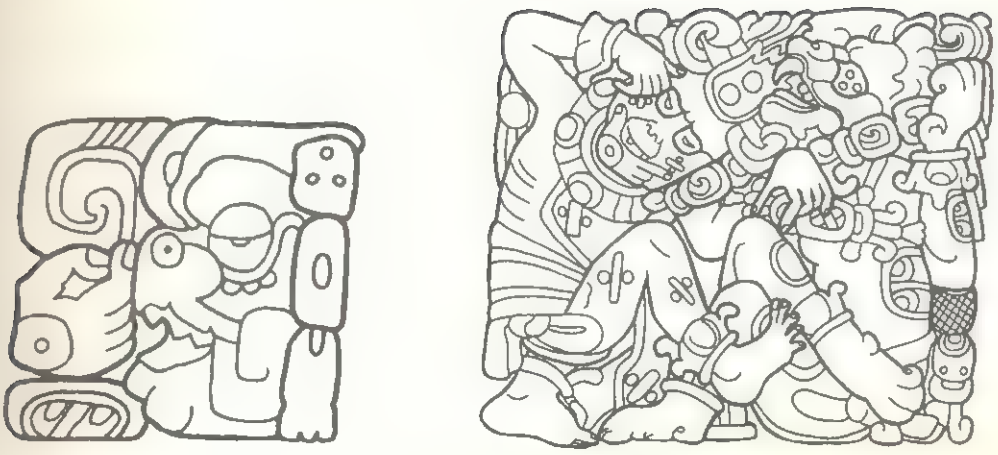
1G8 part of piktun glyph

MRB part of kalab'tun and k'inchiltun glyphs

MRB part of kalab'tun and k'inchiltun glyphs

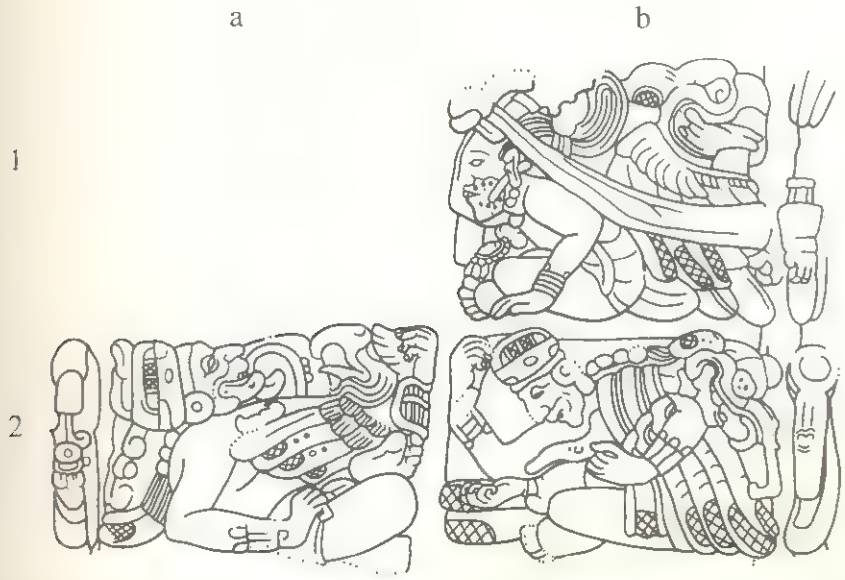
Fig. 17. Graphemes signifying calendrical periods.

While some occasions called for the elaboration and expansion of graphemes, at other times ancient Maya scribes endeavored to conserve space by violating grapheme outlines. Some artists used overlapping, especially right-hand signs over left-hand ones, to compress text horizontally. This process sometimes results in superimposition, in which a grapheme completely obscures the greater part of another sign. An example noted by Stuart (1995:38) is the superimposition of **ajaw** over **wíinik háab'/winik hab'** (ZH1) (figure 20a). A grapheme may occur as an infix, in which it is completely enclosed within the space of a larger sign and yet retains its outline (Kelley 1976:14). For example, Glyph B of the lunar series often has the **ko** syllable



a b

Fig. 18. Full figure variant of a glyphic compound: 0 winals on a. Quiriguá St. A B4 and b. St. D C9–D10.



a b

1

2

Fig. 19. Glyphs for 9 b'ak'tuns (B1), 15 k'atuns (A2), and 5 tuns (B2), from Copán Stela D. Drawing by Linda Schele and Matthew G. Looper.

(1BA) infixed into the **ch'o** animal head (APB) (figure 20b). The logical conclusion of this process of grapheme combination is conflation, in which selected features of two graphemes are fused into a new hybrid sign. The process of conflation is illustrated by the glyph for the haab' period Ch'en, in which the dark pattern of XG8 is combined with 32K (figure 20c).

The rotation of elongated signs around a central main sign does not affect their reading. However, rotating square signs by 90° or 180° does affect the value of the sign (figure 21). The rare **wa** sign, PX3, is a mirror image of the common PC1 **na'; nah; ix-**.

Fig. 20. Modes of grapheme conflation: a. *winik haab' ajaw,* Piedras Negras Lintel 3 U10; b. *ch'ok,* Piedras Negras Lintel 3 B"2; c. *ch'en,* Tikal Temple I Lintel 3 B3.

| | Code | Syllabic value | Logographic value |
|---|---|---|---|
| | AM1 | | ***ahaw / ajaw; nik / nich?*** |
| | AMB | **la** | ***-al*** |
| | APM | **tz'i; xu?** | ***sòotz' / sutz'; ux?*** |
| | APN | | ***tzúutz / *tzutz*** |
| | MR2 | | ***k'äb'; k'äl*** |
| | MR4 | | |
| | MZ6 | | ***ok / och*** |
| | MZP | **k'o** | |

Fig. 21. Square signs differing by 180° rotation.

## The Origin of Graphemes

It has been suggested that graphemes originated as logographic signs (Stuart 1995:35). That is, each sign originally represented a word. It has been further supposed that the change from word to CV syllable sometimes came about through the process of acrophony, or truncation, usually by dropping the final consonant of

a b

Fig. 22. A grapheme derived acrophonically, **ka** from **kay* 'fish' (AA1).

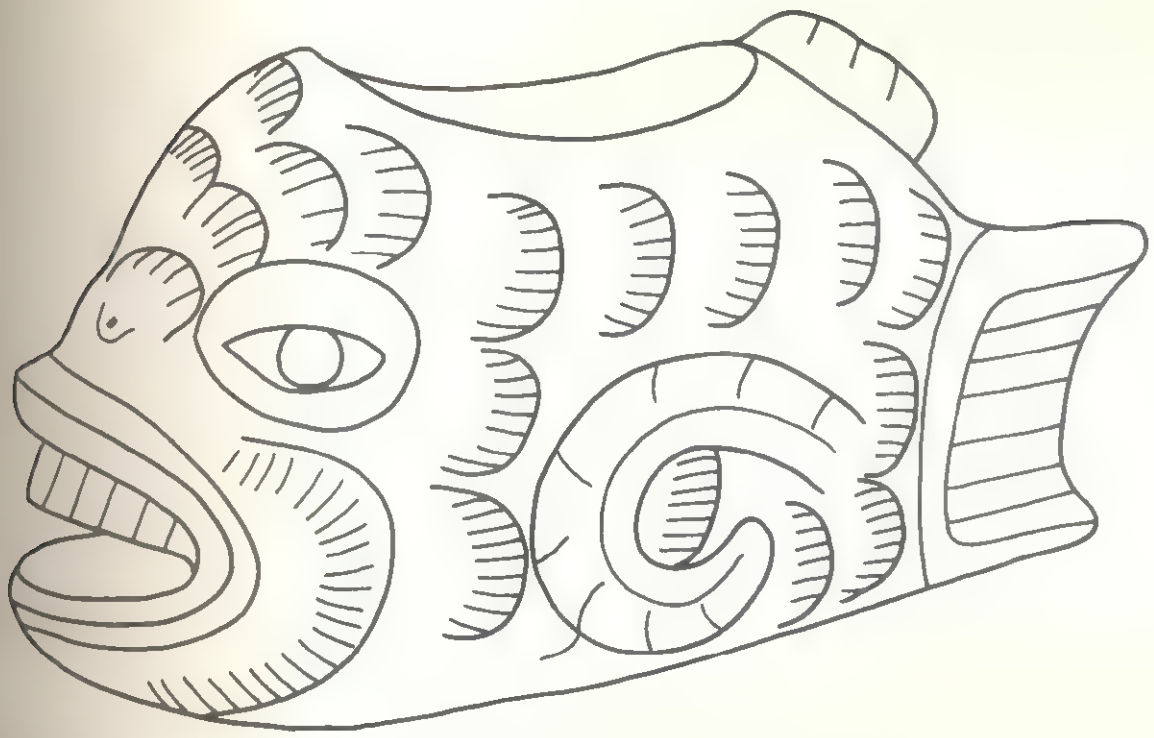


Fig. 23. Ceramic vessel in the form of a fish from the valley of Mexico, Middle Formative period.

a CVC morpheme, leaving only the first consonant and vowel (see Houston et al. 2000:328). The use of the fish scale or fish fin and the image of a fish, AA1, is the best-known example of this process (figure 22). Both the comblike scale/fin and a full fish image signify the syllable **ka**. A striking illustration of the fish and fish scale/fin motif can be seen on a ceramic fish dating to the Middle Formative period, attributed to the Central Mexican highlands (figure 23). Here the connection between the "comb" element and the fish is unmistakable.

Mayan speakers, presumably Yukatekan, associated the comb shape with their word for fish, *kay*, and then used it to represent only the first consonant and vowel of that word. The earliest datable example of the **ka** value of AA1 is on the Early Classic Marcador from Tikal, where it occurs unambiguously in a phonetic

TABLE 6
Cognates for 'Four', 'Sky', and 'Snake'

| | YUKATEKAN | CH'OLAN |
|---|---|---|
| four | *kän* (ITZAJ, MOPAN) | *chän* |
| sky | *ká'an* | *chan* |
| snake | *kàan* | *chan* |

spelling of the month Mak and has no reference to 'fish'. There seems little doubt that the origin of the syllabic value is derived acrophonically from some reflex of proto-Mayan **kar* 'fish'. A Yukatekan or even a K'ichean language would be a more likely source than the Ch'olan and Tzeltalan words for 'fish' that begin with *ch*, as in proto-Ch'olan **chày* (Kaufman and Norman 1984:118). Neither the fish scale/fin nor the full fish image occurs in known examples of the script to represent a word for fish. In all Classic period texts, the grapheme AA1 represents the sound *ka* without any semantic reference to 'fish'.

For many graphemes, there is an evident correspondence between the appearance of the sign and its logographic value: for example, the thigh/torso **kum/chum** (HT8) 'sit'. For some of these logographs, the significance was extended to include homophones of the original referent. A well known example occurs in the use of various signs to represent the Yukatekan and Ch'olan words for 'four', 'sky', and 'snake' (table 6). Some signs substitute for each other in only a limited distribution. In particular, although 'four' can represent the words 'sky' or 'snake', we know of no examples in which either 'sky' or 'snake' is used to indicate 'four'.

Figure 24 lists signs from the Classic period that have phonetically related logographic and syllabic readings. In a majority of the examples shown, the final consonant of the logograph is *h* or *j*. In about a quarter of the examples the final consonant is '. About 10 percent of the examples end in *k*. Other dropped final consonants include *l*, *n*, *y*, and *k'*. Acrophony remained a productive process well into the Classic period, as shown by the occasional use of **b'áalam/b'ahläm** 'jaguar' for **b'a,** in which case the entire final syllable is dropped. For some signs, as with **ka**, the original logographic reference was completely lost, retaining only an acrophonically derived syllabic value.

In summary, there are two possible origins for signs with phonetically related logographic and syllabic values. One is that a syllabic sign might have been extended in an incomplete spelling (not real, only apparent acrophony). True acrophony occurs when a logograph is used to represent a syllable. Only a few signs are polyvalent in that they function in both logographic and syllabic capacities, but with seemingly unrelated values (figure 25).

## GUIDE TO THE CATALOG AND APPENDICES

The index contains images of all the graphemes and grapheme variants described in the *New Catalog*. Beneath each image are the new three-digit code and the original Thompson number. The signs are ordered by grapheme code, beginning with the lettered signs followed by the numbered ones.

As indicated in figure 26, each entry in the body of the *New Catalog* begins with the three-digit code, followed by an image of the grapheme. Then follows the Thompson number, if there is one, and images of the grapheme from Thompson (1962). When Thompson offers multiple variants of a single number, we have not pictured more than three of them; for example, we show only three of the seven variants of T561. Sometimes two or more of Thompson's signs constitute a single grapheme. We have then matched our code with the most common of these.

Directly beneath the three-digit code appear proposed syllabic and logographic values in bold letters. We have proposed values for a grapheme only when general agreement exists among epigraphers and when the

Fig 24. Signs with related logographic and syllabic readings.

values are supported by substitutions, context, or graphic appearance. In general, we have avoided assigning unsupported values. Both Yukatekan and Ch'olan logographic values are given, since the precise reading of a given example can not be determined without phonetic complementation.

The logographic value is italicized. Beneath that is the word class (part of speech), followed by an English gloss for the Mayan word(s). A logographic reading is not necessarily the word for the object repre-

| | Code | Syllabic value | Logographic value |
|---|---|---|---|
| | AA7 | **e** | ***wíinik / winik; winal*** |
| | AC6 | **b'i** | ***kàan / chan*** |
| | ACK | **wa** | ***chapat / chapaht*** |
| | AL8 | **hu** | ***síih / *sih*** |
| | APM | **tz'i; xu?** | ***sòotz' / sutz'; ux?*** |
| | XQB | **ta** | ***k'ät*** |
| | YSB | **b'u** | ***hub'; -ub'?, -b'u?*** |
| | ZC1 | **ku** | ***tùun / tun*** |
| | ZU1 | **ha** | ***k'àal / k'al; -aj*** |
| | ZU1 | **ha** | ***k'àal / k'al; -aj*** |

Fig. 25. Signs with contrasting logographic and syllabic readings.

sented. When the Yukatekan and Ch'olan forms are different, a slash divides the two, with the Yukatekan form first. To the right of the logographic reading is an English gloss. All of this information is repeated for every variant, even though not every variant occurs in all possible contexts or is necessarily identified with all of the proposed values.

Some signs have logographic value, but no English gloss is available. A few signs, such as 'temple; pyramid', 'eclipse', and 'Mars', have an English gloss but no confirmed reading in Yukatekan or Ch'olan. Multiple logographic readings are separated by semicolons. Selected definitions and glosses for logographs are provided from contemporary and colonial dictionaries for Yukatekan languages (Yukatek, Itzaj, Lakantun, Mopan) and Ch'olan languages (Ch'ol, Chontal, Ch'olti', Ch'orti') with proto-Ch'olan forms when available. Lexical sources are listed only with the first example of each grapheme.

Following the lexical entries appears information concerning calendrical significance. Notes that refer to other information about the sign follow the lexical sources. Beneath that is a number for each grapheme variant (unique or first variants have *1*) and a phrase describing the grapheme's appearance or identification. Sometimes the descriptive phrases are quite speculative; they are intended only for verbally distinguishing the images.

For each grapheme, and frequently for some of its variants, we have listed proposed interpretations with their bibliographical citations. These are divided into five chronological periods:

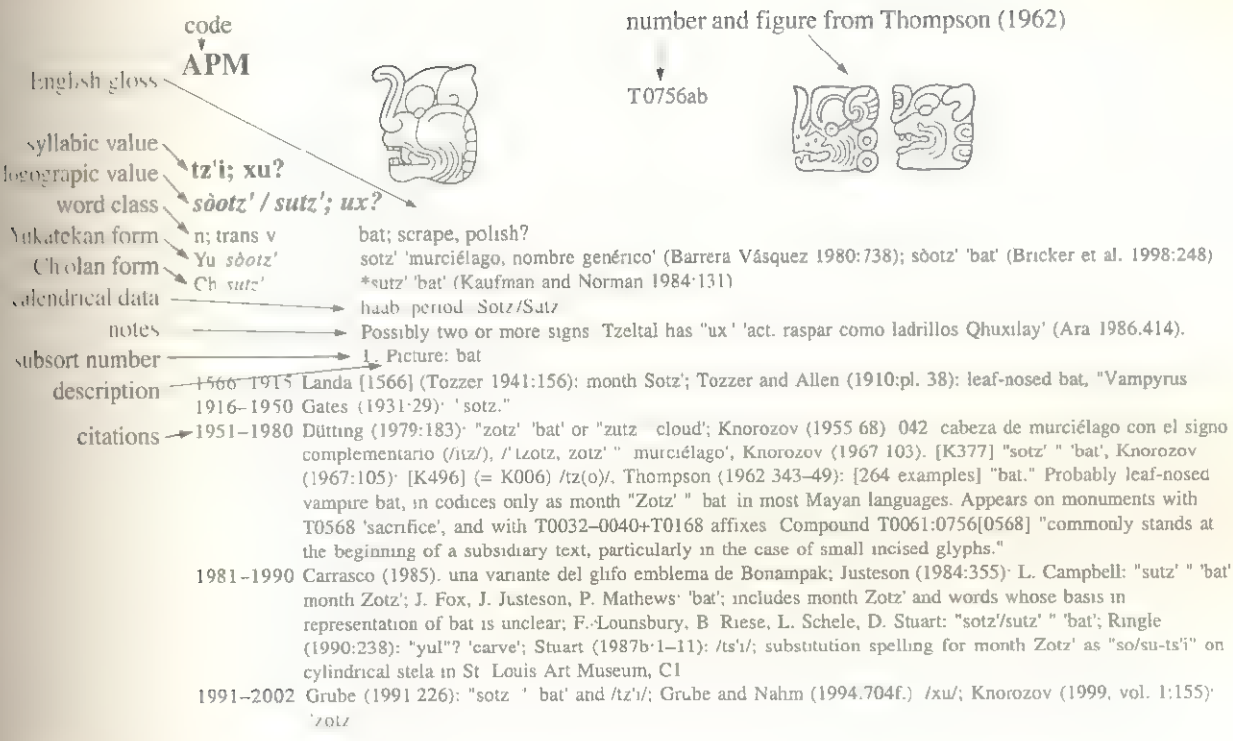



Fig 26 A sample catalog entry.

1566–1915: includes Landa's "alphabet," material from the Codex Pérez, and readings by Brasseur de Bourbourg, Goodman, Rosny, Schellhas, Seler, Thomas, Tozzer and Allen, and other early scholars;

1916–1950: includes readings by Morley, Gates, and Thompson's summary of the field to 1950, *Maya Hieroglyphic Writing: An Introduction;*

1951–1980: contains material by Berlin, Kelley, Knorozov, Prokouriakoff, Thompson's *Catalog* (1962), and early material by Lounsbury, Mathews, and Schele;

1981–1990: contains the summary of readings in Justeson (1984), material from Bricker's grammar (1986), the sign list from Grube (1989), and readings by Fox, Houston, Justeson, MacLeod, Schele, Stuart, and many other contributors;

1991–2002: includes summary readings by Davoust, revisions to the Thompson (1962) classification by Ringle and Smith-Stark (1996), the recent summary of Knorozov (1999), and decipherments by various epigraphers.

Within each of the chronological headings, the citations are listed alphabetically by author. The list is not comprehensive but does contain sufficient information so that the reader can trace the progression of decipherment. Sometimes a correct reading was given early on, dismissed, and not taken up again for many decades. In others, early scholars surmised a correct reading, but only later was substitution evidence presented to confirm the reading. Such cases underscore the nature of the decipherment process as cumulative and inclusive of the work of many scholars. Generally, we have not presented supporting evidence or summarized arguments for these readings, except to give syllabic substitutions for logographic signs, when noted in the literature. The arguments in favor of syllabic readings are often so complex and extended that it is impossible to summarize them in a cursory fashion.

Most citations are of primary sources in which authors develop their own arguments for decipherment. In some, however, the author merely refers to a reading, suggesting only acceptance of someone else's proposal. Much of the early work by Förstemann, Schellhas, and Seler is cited in the English translations, which appeared several years later than the original publication. For example, Schellhas's articles on deity names was first published in 1897, while the English version did not appear until 1904. Most of Seler's work was republished several times. The later versions sometimes contain Seler's own revisions. We have usually cited early material from later English-language editions (e.g., Seler 1976, 1990, 1992), providing the dates of the original publication in brackets. For details on the publication of these items, see the editorial notes in the later editions.

Our coverage of the earliest work is not comprehensive. We have cited only a sampling of early readings, a large number of which have proved to be insupportable, sometimes including unidentifiable graphemes or elements that are now recognized as subgraphemic particles. We have made an effort to include references to those readings that have later been demonstrated to be correct. Many early decipherments consist merely of a passing remark or observation embedded within long discussions of a variety of topics. Students of the history of decipherment can be assured that many gems of insight await rediscovery in the works of these early writers. Houston et al. (2001) is a collection of primary source materials, containing forty-eight articles.

Some of the citations listed in this catalog are secondary sources—that is, another researcher is quoted or credited with a particular reading. Two summaries, Kelley (1962c) and Justeson (1984), were especially complete for their periods. In both publications, the authors provide initials to refer to scholars. In the *New Catalog* we have indicated the first initial and spelled out the appropriate last names. This format distinguishes these references from citations to published sources, for which the last name and date are given.

Material from Justeson (1984) appears in about a third of the entries and has been modified in several ways. Diacritics indicating the originator of a reading are not included, "??" is now "?," "#" has been omitted, "emblem glyph main sign" has been shortened to "emblem glyph," "day sign" to "day," "month sign" to "month," and so forth. We have used "<" to indicate "for," "from," "origin in," and "based on" and "=" for "is same as," "equivalent to," and "equals." The labels "logographic" and "phonetic" have been eliminated before readings, since this distinction is indicated in this catalog by double quotation marks and slashes respectively. The reader is encouraged to refer to the original source for additional information.

When Thompson (1962) provides more than one example of an affix, he does not letter them (a, b, etc.). Letters for variants of affixes cited in Justeson (1984) as well as in Grube (1990a) and Ringle and Smith-Stark (1996) are not always equivalent, though the relevant citation appears in the appropriate entry in this catalog.

In a few cases, we have relied on personal communication for unpublished glyph readings. In the last three decades progress has proceeded at a rapid pace. Many decipherments are presented at professional meetings and workshops or circulated in unpublished papers long before they appear in print. The author of the earliest cited publication is therefore not necessarily to be credited with decipherment. We have made every attempt to credit appropriately those responsible for recognizing or explicating new readings. The purpose of this study is not to assign single credit to specific researchers, however, but to document the cooperative nature of the enterprise and flow of ideas. Throughout the history of research, simultaneous independent decipherments frequently resulted from the accretion of previous readings and the always increasing number of available texts. The notebooks prepared by Linda Schele for the Maya Meetings at the University of Texas at Austin are particularly important for summarizing the latest research each year.

Following the body of the *New Catalog* are the appendices. In most of the appendices and figures, logographic values are shown in lowercase bold italics and phonetic values are shown in lowercase boldface. Appendix 1 is a list of graphemes arranged alphabetically by proposed syllabic values. Appendix 2 is a list of

graphemes with proposed values arranged alphabetically by Mayan words. Appendix 3 lists signs with logographic value ordered by English glosses. Appendix 4 lists the correspondence of our codes with the numbers assigned by Gates (1931), Zimmermann (1956), and Knorozov (1967). Appendix 5 shows the signs from Thompson (1962) that we have identified as conflations and therefore have not given grapheme status.

At the beginning of his *Catalog of Maya Hieroglyphs*, Thompson warns, "Fellow epigraphers, of your charity do not improve this system; confusion will outweigh gain and tinkered pans soon leak" (1962:34). We would like to emphasize that the *New Catalog* is not, in fact, an attempt to modify his system. On the contrary, we have attempted to organize the graphemes in an entirely different way that in certain respects recalls earlier systems. For those signs Thompson identified, the original, untinkered T-number remains.

Unlike Thompson's catalog, we have not listed the monument and coordinate of all known examples. Such a concordance, along with a lexicon of logographic and phonetically spelled words, can be generated from the Maya Hieroglyphic Database. The *New Catalog* has added a significant number of new signs, supplied new drawings for all signs, provided precise language-specific spellings and lexical entries for all proposed logographic readings, and listed significant publications. Our efforts have been enhanced by access to an increasingly complete body of lexical data and an ever-growing corpus of Maya texts. It is our hope that this summary of current knowledge will be a valuable tool for scholars, students, and interested laypersons as well as students seeking to understand this extraordinary writing system.

# *Appendix 1. Signs with Proposed Syllabic Values with Code and Thompson Number*

a
AL2

a
AL2

a
AL2

a
AMG

a
BP1

a
BP1

a
BP1

a
MB1

a
1G4

a; ha
BP3

b'a
AP9

b'a
AP9 

b'a
AT1

b'a
AT1

b'a
PCB

b'a
PT9

b'a
SC2

b'a
SCM

b'a
XE1

b'a
XE1

b'a
XE2

b'a
ZX5

b'a
33H 

b'e
APD

b'e; b'i
HTF

b'i
AC6

b'i
AC6

b'i
XGE

b'o
HM1

b'u
YSB

b'u
YSB

ch'a
2G2

ch'a
2G2

ch'a
2G2

ch'o
APB

cha
MZ9

cha; se
XS3

cha; se
XS3

cha?
2S4

cha?
32F

che
1B7

che
1B7

chi
AV1

chi
MR7

chi
MR7

chi
SC9

cho
HJ1

cho
HJ1

chu
ZY9

chu?
HT6

e
AA7

ha
SC3

ha
ZU1

ha
ZU1

ha
ZU1

ha
ZYB

he
AV3

he
ZU8

he
33B

he
33B

he?
SNA

hi
APC

hi
1M1

hi
32K

hi
32K

hi 32K

hi 33F 

hi 33F 

ho MZ4

ho PT5

ho SN8

ho ZUF

ho ZUF

ho 005 

hu AL8

hu MZF

hu 1G5 

hu 1G5 

ı BV8

i YM1

i YM1

ju? 001 

k'a MZ3

k'a MZ3

k'a 2S6

k'a 2S6

k'a 2S6

k'a? SSB

k'a? ZS9

k'a? 32P 

k'a? 32P

k'a? 32P

k'a?, k'i? BM1 

k'a?, k'i? BM2

k'a?, k'i? BM2

k'a?, k'i? BM2 

k'a?, k'i? BM2 

k'a?, XGF

k'e ZY8

k'o MZP

k'o MZP

k'u BP7

k'u 22B

k'u 22B 

ka AA1

ka AA1

ka AA1

ka AA2

ke MZA

ke MZA

kı BT5

ki 1B2

ki 1B2

kı 1B2

ko HJ3

ko 1BA

ku ZC1

ku ZC1

la AMB

la AMB 

la AMB

le AP3

le ZSD

le 1SC 

le 1SC

li BV5

lı 1G3

li 1M4

li 1M4

li 1SB

lo XGA

lo XGA

lo XGA

lu ZUG

lu ZUG

lu ZUG

ma XE3

ma 32A

ma 32A

ma 32A

ma 32U

ma 33K

me XE6

mi MR1

mi MR1

mi ZQ4
mi? PM7
mo BP5
mo BP5
mu YSA
mu YSA
na PC1
na PX4
na PX4
na XD5
na 1G1
na 1G2
na 1G2 
na 1G2
na 1M3
na 2M4

na 34A
ne ATB
ne ATB
ne 1S3
ne 1S3
ni 1S2
ni 1S2
no ZD2
no ZD2
nu 22F
nu 22F
nu 22F
nu 22F 
nu 3M9 
nu 3M9
nu 3M9

o BT1
o BT1 
o BT1
o BT1
o 1SJ 
o 32E
o? 32E
p'e? AX6
p'e? PEC
pa XD1
pa XD1
pa ZUA
pi SB1
pi ZC5
pi ZC5
pi ZC5

po XG3
po XG3
pu XH7
sa PM1
sa PM1
sa XV4
sa XV4
sa 32C
sa 32R
sa 32R
si 3M6
su 1B3
t'u XE4
ta SCG
ta XQB
ta YM2

ta YM2
ta ZS1
ta ZS1
ta 1B1
ta 1B1
ta 1B1
ta 3M3
te ST4
te ST4
te ST4
te ST4 
te XGC
te YG1
te ZZ5
te 2G1
te 2G1

ti
BV3

ti
3M2

ti
3M2

to
33A

to
33A

to
33A

tu
3M4



tz'a
XQ7

tz'a
3M7

tz'a
3M7

tz'i
AP1

tz'i
XV1

tz'i;
xu?
APM

tz'i
AA3

tza
ZZA

tzi
BVA

tzi
XH5

tzi
XH5

tzi
XH5

tzi
XH5

tzi
ZU5

tzi; ki
32J

tzu
SSJ

tzu
ZS4

tzu
ZS4

u
AA4

u
AA4

u
AMF

u
AT8

u
HE6

u
HE6

u
HE6

u
HE6

u
HE6

u
HE6

u
PC7

u
PE5

u
PE5

u
YG2

u
YG2

u
YG2

u
33D



wa
ACK

wa
ACK

wa
ACK

wa
PX3

wa
PX3

wa
2S2

wa
2S2

wa?
XH4

wa?
XH4

wa?
XH4

wa?
ZUB

wi
1S1

wo
1SF

xa
XG4

xa
XG4

xi
SC5

xo
AM6

ya
SCJ

ya
32M

ye
MZR

ye
PH3

ye
ZY7

ye
ZY7

yi
ZUH

yi
ZUH

yi
ZUH

yi
ZUH

yo
MZC

yo
1SA

yu
32D

# *Appendix 2. Signs with Proposed Logographic Values Ordered by Yukatekan/Ch'olan Glosses*

aj
ZU1

-al
AMB

-b'u?
YSB

-el
AP3

-el
1SC


-hi
APC

-hi
1M1

-hi
32K

-hi
33F

-i
SCJ

i
32M

-i(y)?
PH3

-il
BV5

-il
1G3

-il
1M4

-il
1SB

-pih
XH3

-pih; pih
SB1

-pih; pih
ZC5

-tak?
ZS5

-tzuk
ZS4

-ub'?
YSB

-Vm
32U


-Vw?
2S2

-Vw?
1S1


-y
ZUH

a-; ah/aj
AL2

àach/at?
HM2

àach/at?
SS3

àak'/ak'
XH9

áak'äb'/ahk'ab'
XH9

áak/ahk
AL1

áak/ahk
AL3

áak/ahk
SNN

àal/al; á'al/äl
MZE

àal/al?
BM4

áayin/ahin
AL6

ab'ak/ab'äk?
YGA

ah/aj; -ah?
1G4

ahaw/ajaw
AM8

ahaw/ajaw
AX1

ahaw/ajaw
BV1

ahaw/ajaw
BV2

ahaw/ajaw
PT7

ahaw/ajaw
XD4

ahaw/ajaw
ZB3

ahaw/ajaw
2M1

ahaw/ajaw
AM1

ak
APH

äk'
XH9

äk'
YG5

an?; anum?
ZS7

b'àak/b'ak
HH1

b'àak/b'ak
HJ1

b'àak/b'ak
SCM

b'àak/b'ak
SC2

b'áalam/b'ahläm
AT1

b'áalam/b'ahläm
PT9

b'àatz'/b'atz?
AMH

b'äh/b'ä; b'ah
AP9

b'äh/b'ä; b'ah
XE1

b'ak
BM8

b'alaj
1C2

b'éeh/b'ih
XGE

b'ix
YG6

b'olon
009

b'olon
PT9

b'uluk/b'uluch
PM6

b'uluk/b'uluch
PE1

b'ux?
ZS4

ch'ab'/ch'ahb'
PTC

ch'ab'/ch'ahb'
ZYC

ch'ah
2G2

ch'ahom(a)
PH8

ch'äk
2M7

ch'äm
MZD

ch'amak
AP4

ch'é'en/ch'en
MB8

ch'é'en/ch'en?
BT6

ch'é'en/ch'en?
HH2

ch'é'en/ch'en?
ZC4

ch'ix?
AA5

ch'o'/ch'o'(k)
APB

ch'ok
HE5

ch'ok?
ZQB

ch'uhul
AMD

ch'uhul
PED

ch'uhul
YGB

ch'uhul; ch'uh
AMC

ch'uhul; ch'uh
PH1

cha'
002



cha'
MZ8

cha'an?
AC1

cháak/chahk
SS1

chäk
HJ2

chäk
1B9

chäm
SCC

chan
XH3

chan
SB2

chan
AC6

chan
ACH

chan
004



chän
SN4

chän
SN1

chän
004



chapat/chapaht
ACK

chèem?
ZVF

chij
AV1

chitam
APH

choh/chok
MZS

choj?
ATC

chum
HT8

chum
HTA

chum?
HT9

chúuh?
ZS4

chuwen
ZE2

chuwen
AMK

éeb'/ehb'
ZH5

éeb'/ehb'
ZY2

éek'
XG8

èek'/ek'
ZQD

éem/ehm?
HT4

ehch'ak
AT9

el
ZVE

et
ZZ5

ha'
AL2

ha'
BP1

ha'
XE2

ha'
ZUP

ha'
33G

ha'
SS6

ha'?
SS5

há'ab'/hab'
SB5

há'ab'/hab'
SS8

há'ab'/hab'
XH2

há'ab'/hab'
SB4

ha'l/häl
ZQ9

hix
AT1

hix
AT7

ho'
MZ4

ho'
PT5

ho'
005

hoch'?
MR9

hoy/joy?
ZB1

hoy/joy?
ZY1

hú'un/hun
SSC

hú'un/hun
XHB

hú'un/hun
XS2

hú'un/hun
1B5

hú'un/hun?
AM3

hub'
YSB

hub'?
ZQE

huk
ST7

huk
007

hul
HTE

hul
MRA

hul
ZU3

hul
1G5

hùuh/huj
AL9

ii/i
BV8

ii/i
YM1

íich'ak
AT9

ìik'/ik'
XQ6

ìik/ik'
PT3

ik'
XG8

il
AL4

il
HE1

in-
1S2

itz'at
BT8

itz'at
ZE2

itz'at
AMK

itzamnah
SSD

ix-
PC1

jäl
ZQ8

jalal/jaläl?
ZZ8

janab'
BT7

janab'
XGG

jó'ol/jol
SC2

joy?
ZV1

jukub'?
ZVF

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Facultad de Ciencias Antropológicas
Centro de Información Científica
"Dr. Alfredo Barrera Vásquez"

jul?
ZYD

jun
MBA

jun
001


k'a'
BM2

k'a'
XGF

k'a'
BM1

k'á'ah/k'ah?
SSB

k'á'ah/k'ah?
ZS9

k'á'ah/k'ah?
32P

k'àab'a'/k'ab'a'
ZE1

k'áak'/k'ahk
2S6

k'àal/k'al
ZZ1

k'àal/k'al
ZU1

k'àal/k'al?
HTD

k'äb'
MZ1

k'äb'
MR2

k'äl
MR2

k'äl
AX3

k'äl?
ZH8

k'äm
MZD

k'än
XQ1

k'ät
XQB

k'atun
SB4

k'atun
SB2

k'atun
SB3

k'atun
ZH1

k'awil
SSF

k'ayom(a)
PC5

k'i'ix?
AA5

k'îin/k'in
XQ3

k'îin/k'in
AMK

k'îin/k'in
SN4

k'inich
SN3

k'uk'
BP7

k'uul
AMD

k'uul
PED

k'uul
YGB

k'uul; k'uh
AMC

k'uul; k'uh
PH1

k-/kä-
AA1

ká'ah
002

ká'ah
MZ8

ká'an
XH3

ká'an
SB2

ká'an
004

kàab'/kab'
PE1

kàab'/kab'
YS1

kàah/kah
XG2

kàan
AC6

kàan
ACH

kalom
SCK

kalom
SS2

kalom
ZX3

kän
SN4

kän
SN1

kän
004

kéeh
AV1

kelem
MZB

kíim
SCC

kitam
APH

ko'haw
ZD5

koh?
ATC

ku(y)/kuh
BT4

kum
HT8

kum
HTA

kum?
HT9

kùuch/kuch?
MB3

kùuch/kuch?
ZB2

kùuch/kuch?
32B


làak/lak
ACJ

làak/lak
ZVB

làak/lak
ZVC

lajka'/lajchän
PT2

lajun/läjun
MB7

lajun/läjun
SC1

lakam
ZS8

lok'?
AC3

ma'
32A

màax/max
AME

mam
BVD

mam
SNG

man
ACL

mas
SCL

mat
BM7

may?
AV7

mix?
ZQ4

mo'
BP4

mo'
BP5

mu'ut
HB1

mu'ut
PE4

muk
SCF

muwan
BT2

muyal
XGK

na'
PC1

náab'/nahb'
MR5

naab'; nahb'
SCA

naab'; nahb'
XD6

naab'; nahb'
2S3


naab'?; nahb'?
XG7

naab'?; nahb'?
XQ9

naab'?; nahb'?
SS5

nah
PC1

nah
1G2

nah
ZY5

näl
32G

näl; nal
2S1


näl; nal
PE8

neh; néen/nehn
1S3

nik/nich; nikte'
XQ2

nik/nich?
AM1

nik/nich?
AM4

nùuk/nuk; num?
22F


nùuk/nuk; num?
3M9

ok/och
ACN


ok/och
MRC

ok/och
MZ6

ok/och
MZ7

ok/och
AP5

óol/ol
XH4

óox
PT3

otoch/otot
ZY5

oxlajun
SS6

oxlajun
SS4

oxlajun
SS5

päkal
XD2

päkal
XQC

päs
MZ2

päs
SCP

päs
ZX2

pät
2G4

pawah(tun)
PT4

pèek'?
AP1

pèet/pet
XG1

puh/puj
XH7

pul
PT1

sa'
PM1

sa'
32R

säk
MZ8

säk
3M1

síih/*sih
AL8

síih/*sih
ZU7

síih/*sih
2S7

síih/*sih
3M6

sòotz'/sutz'
APM

t'äb'?
ZY1

ta,tä
YM2

ta,tä
BV3

ta,tä
3M2

ta,tä
3M3

ta,tä; täj
1B1

táan/tan
YM3

tal
YS7

te'
33C

te'; -te
ST4

te'; -te
XGC

te'; -te
YG1

te'; -te
2G1

te'; -te
ZZ5

ti'/ti
BV3

ti'/ti
3M2

ti'/ti
3M3

tihl; til
APG

til
MB4

tòok'/tok'
1C1

tòok'/tok'?
22E

tóok/tohk
33A

tòon?
HM2

tòon?
SS3

tu
3M4

tùun/tun
ZC1

tùup/*tup?
ZSG

tz'áak/tz'ak
YS6

tz'áak/tz'ak
ZX6

tz'am?
XHA

tz'am?
XQ7

tz'i'
AP1

tz'íib'/tz'ihb'
MR6

tzak/tzäk
MZK

tzih
XH5

tziimin?
APG

tzik?
32J

tzul?
AP1

tzúutz/*tzutz
APN

tzúutz/*tzutz
MRB

u-
AA4

u-
AMF

u-
AT8

u-
HE6

u-
PC7

u-
PE5

u-
YG2

u-
33D

uch'/uk'
PM4

uch?
AP5

uh
SCH

ux
PT3

ux?
APM

uxläjun
SS6

uxläjun
SS4

uxläjun
SS5

uy-/(u)y-
PH3

uy-/(u)y-
32M

uy-/(u)y-
ZUH

uy-/(u)y-
MZC

uy-/(u)y-
MZR

uy-/(u)y-
ZY7

uy-/(u)y-
1SA

uy-/(u)y-
32D

wa'
SSL

wáak/wäk
PH6

wáak/wäk
006

wáak/wäk
32T

wáay/way
AM7

wáay/way
AT2

wáay/way
YS8

wáay/way
ZSF

wáay/way
PE4

wáay/way?
ZUB

waxak
PE8

wi'
1S1


wi'?
ZQB

wi'il
1S1

wi'il
YG4

wi'il
YS3

winik
ZU2

winik hab'
SB4

winik hab'
SB2

winik hab'
SB3

winik hab'
ZH1

winik; winal
AA7

winik; winal
AM2

winik; winal
AM9

winik; winal
XS1

winik?
HTD

witz
ZC2

wúuk
ST7

wúuk
007

xìib'/xib'?
HT2

xìib'/xib'?
PC4

yáax; yäx
PT9

yáax; yäx
ZUJ

yäl
MZE

yaxun?
BM1

yi'ih
ZUH

yo'pat?
HM2

yo'pat?
SS3

yotoch/yotot
BM3

yotz
HB2

# *Appendix 3. Signs with Proposed Logographic Values Ordered by English Glosses*

agentive
AL2

agentive
1G4

ajaw
AM8

ajaw
AX1

ajaw
BV1

ajaw
BV2

ajaw
PT7

ajaw
XD4

ajaw
ZB3

ajaw
2M1

ajaw
AM1

alligator
AL6

altar?
ZC4

and then
BV8

and then
YM1

arm
MZ1

arm
MR2

arrive
HTE

arrive
MRA

arrive
ZU3

arrive
1G5

artificial
3M1

artist
BT8

artist
ZE2

artist
AMK

ascend?
ZY1

atole
PM1

atole
32R

b'ak'tun
SB1

b'ak'tun
ZC5

b'ak'tun
XH3

b'ak'tun
SB2

banner?
ZS8

bat
APM

black
XG8

bless?
ZB1

bless?
ZY1

blue
PT9

blue
ZUJ

bone
HH1

bone
HJ1

bone
SCM

bone
SC2

book
SSC

book
XHB

book
XS2

book
1B5

book?
AM3

born, be
AL8

born, be
ZU7

born, be
2S7

born, be
3M6

bottle gourd?
ZS4

breath
XQ6

breath
PT3

bright
3M1

build
2G4

building
1G2

burden?
MB3

burden?
ZB2

burden?
32B

burn
ZVE

burn
PT1

burn
APG

burn
MB4

burn
33A

bury
SCF

canoe?
ZVF

captive
HH1

captive
HJ1

captive
SCM

captive
SC2

carry?
MB3

carry?
ZB2

carry?
32B

carved?
ZS7

cattail
XH7

cave
MB8

cave?
BT6

cave?
HH2

cave?
ZC4

celt
1M5

censer
PH8

centipede
ACK

Chaak
SS1

charcoal
YGA

child of father
AM1

child of father
AM4

child of mother
MZE

child of mother?
BM4

claw
AT9

close
MR2

close
AX3

close
ZH8

cloth
SB1

cloth
ZC5

cloud
XGK

companion
ZZ5

complete
APN

complete
MRB

conch trumpet
YSB

conjure
MZK

cormorant
BM7

maize tassel
ZUH

cotinga?
BM1


count?
32J

crocodile
AL6

cross
XQB

crown?
HM2

crown?
SS3

cut
2M7

dawn
MZ2

dawn
SCP

dawn
ZX2

day-night
XQ5

deer
AV1

descend?
HT4

die
SCC

dog
AP1

dream
AM7

dream
AT2

dream
YS8

dream
ZSF

dream
PE4

drill?
MR9

drink
PM4

droplet
2G2

earring?
ZSG

earth
PE1

earth
YS1

eclipse?
XQ5

egret, snowy
BM8

eight
PE8

elevated
XH3

elevated
SB2

elevated
004

eleven
PM6

eleven
PE1

end
BM2

end
XGF

end
BM1

enter
ACN

enter
MRC

enter
MZ6

enter
MZ7

enter
AP5

exchange
YS6

exchange
ZX6

fall?
ZQE

famous?
ZS7

fasten
MR2

fasten
AX3

fasten?
ZH8

finish
APN

finish
MRB

fire
2S6

first
AP9

first
XE1

first
PT9

first
PC1

first
1G2

first
ZUJ

five
MZ4

five
PT5

five
005

flint
1C1

flint?
22E

flower
XQ2

flower?
AM1

foot
AP5

four
SN4

four
SN1

four
004

fox
AP4

front, in
YM3

give
XH9

give
YG5

go away
YG6

god
AMC

god
PH1

grandfather
BVD

grandfather
SNG

great
HJ2

great
1B9

green
PT9

green
ZUJ

hand
MZ1

hand
MR2

handspan?
MR5

hawk
BT2

he/she/it
PH3

he/she/it
ZUH

he/she/it
AA4

he/she/it
AMF

he/she/it
AT8

he/she/it
HE6

he/she/it
PC7

he/she/it
PE5

he/she/it
YG2

he/she/it
33D 

he/she/it
MZC

he/she/it
MZR

he/she/it
ZY7

he/she/it
1SA

he/she/it
32D 

he/she/it
32M

head
SC2

headband
SSC

headband
XS2

headband
1B5 

headband?
XHB

headband?
AM3

heart
XH4

helmet
ZD5

heron
BM9

hill
ZC2

holy
AMD

holy
PED

holy
YGB

holy
AMC

holy
PH1

hoof?
AV7

house
1G2

house
ZY5

house
BM3

howler monkey?
AMH

hunter?
SCK

hunter?
SS2

hunter?
ZX3

I; my
1S2

iguana
AL9

image, carved
AMC

image, carved
PH1

important
XH3

important
SB2

important
004

in, at
YM2

in, at
1B1

in, at
BV3

in, at
3M2

in, at
3M3

in, at
3M4

injure
2M7

ink?
YGA

Itzamnah
SSD

jaguar
AT1

jaguar
PT9

jaguar
AT7

k'atun
SB4

k'atun
SB3

k'atun
ZH1

K'awil
SSF

k'in
XQ3

k'in
AMK

k'in
SN4

lacking
1S1

lacking
YG4

lacking
YS3

lake
SCA

lake
XD6

lake
2S3

lake?
XG7

lake?
XQ9

lake?
SS5

large
HJ2

large
1B9

large
ZS8

large
22F

large
3M9

last
1S1

last
YG4

last
YS3

leave?
AC3

low
YS1

macaw
BP4

macaw
BP5

maize
32G

maize
2S1

maize
PE8

make
2G4

male?
HT2

male?
PC4

manifest
ZQ9

many
009

many
PT9

Mars
ACD

middle, in the
YM3

mirror
1S3

monkey, howler?
AMH

mother
PC1

mountain
ZC2

name
ZE1

necklace
SCH

new
XH5

night
XH9

night?
XQ5

nine
009

nine
PT9

no, negative
32A

noun suffix
AMB

noun suffix
AP3

noun suffix
1SC

noun suffix
BV5

noun suffix
1G3

noun suffix
1M4

noun suffix
1SB

noun suffix
1G4

noun suffix
YSB

num. classifier
ST4

num. classifier
XGC

num. classifier
YG1

num. classifier
2G1

num. classifier
ZZ5

num. classifier
ZS4

num. classifier
XG1

num. classifier
YS7

one
MBA

one
001

one
PC1

open
MZ2

open
SCP

open
ZX2

opossum?
AP5

owl
BT4

paint
MR6

paint?
2S3

paper
SSC

paper
XHB

paper
XS2

paper
1B5

paper?
AM3

Pawahtun
PT4

peccary
APH

penance, do
PTC

penance, do
ZYC

penis?
HM2

penis?
SS3

person
AA7

person
AM2

person
AM9

person
XS1

pierce?
ZYD

place
XG2

plait
ZQ8

planet
ZQD

plate
ZVB

plate
ZVC

platform
1B8

plaza?
ZC4

plumeria
XQ2

plural marker?
ZS5

polish?
APM

portal
XH4

pour?
ZV1

precious
XQ1

puma?
ATC

pyramid
ZH4

quetzal
BP7

rat
APB

raw
XH5

receive
MZD

record?
SSB

record?
ZS9

record?
32P

red
HJ2

red
1B9

reed
XH7

region
YS1

ripe
XQ1

road
XGE

root
1S1


root?
ZQB

round, make
XG1

say
MZE

scatter
MZS

scatterer
PH8

scrape?
APM

scribe
BT8

scribe
ZE2

scribe
AMK

sculpt
2G4

see
AL4

see
HE1

self
AP9

self
XE1

seven
ST7

seven
007

shell trumpet
YSB

shield
XD2

shield
XQC

since?
AC1

singer
PC5

sit
HT8

sit
HTA

sit?
HT9

six
PH6

six
006

six
32T

sky
XH3

sky
SB2

sky
004

sleep
AM7

sleep
AT2

sleep
YS8

sleep
ZSF

sleep
PE4

snake
AC6

snake
ACH

snowy egret
BM8

sorcerer
AM7

sorcerer
AT2

sorcerer
YS8

sorcerer
ZSF

sorcerer
PE4

sorcerer?
ZUB

spear thrower?
ZZ8

spider monkey
AME

spine?
AA5

spirit being
SCL

spirit companion
AM7

spirit companion
AT2

spirit companion
YS8

spirit companion
ZSF

spirit companion
PE4

spirit companion?
ZUB

sprout
ZUH

sprout
HE5

sprout?
ZQB

stairway
ZH5

stairway
ZY2

stand up
SSL

star
ZQD

stone
ZC1

succession
YS6

succession
ZX6

sun-faced
SN3

tail
1S3

take
MZD

tapir
APG

temple
ZH4

ten
MB7

ten
SC1

thirteen
SS6

thirteen
SS4

thirteen
SS5

three
PT3

throne
ZE5

throne
ZE6

throne?
XHA

throne?
XQ7

throw
MZE

time period
007

tongue
XH9

town
XG2

town
2S1

town
PE8

transform
AM7

transform
AT2

transform
YS8

transform
ZSF

transform
PE4

tree, wood
33C

tree, wood
ST4

tree, wood
XGC

tree, wood
YG1

tree, wood
2G1

tree, wood
ZZ5

tun
SB5

tun
SS8

tun
XH2

tun
SB4

turtle
AL1

turtle
AL3

turtle
SNN

twelve
PT2

twenty
ZZ1

twenty
ZU1

twenty
ZU2

twenty
HTD


two
002

two
MZ8

upright
PH6

upright
006

upright
32T

Venus
ZQD

verbal suffix
APC

verbal suffix
1M1

verbal suffix
32K

verbal suffix
33F

verbal suffix
SCJ

verbal suffix
PH3

verbal suffix
32U

verbal suffix
2S2

verbal suffix
ZUH

verbal suffix
ZU1

verbal suffix
32M

verbal suffix
1S1

vision?
ACL

warrior
SCK

warrior
SS2

warrior
ZX3

water
AL2

water
BP1

water
XE2

water
ZUP

water
33G

water
SS6

water?
SS5

waterlily
SCA

waterlily
XD6

waterlily
2S3

waterlily?
XG7

waterlily?
XQ9

waterlily?
SS5

we; our
AA1

weave [net]
ZQ8

weave [on loom]
ZQ9

well
MB8

well?
BT6

well?
HH2

well?
ZC4

white
MZ8

white
3M1

winal
AA7

winal
AM2

winal
AM9

winal
XS1

wind
XQ6

wind
PT3

wise?
22F

wise?
3M9

with
ZZ5

witness
AL4

witness
HE1

woman
PC1

write
MR6

year
SB5

year
SS8

year
XH2

year
SB4

yellow
XQ1

you; your
AL2

young male
MZB

zero
SN6

zero
ZQ4

zero?
MR3

# *Appendix 4. T-Number, Code, Gates (1931), Zimmermann (1956), Knorozov (1967)*

| T# | Code | Gates | Zimm | Knor |
|---|---|---|---|---|
| 0001 | HE6 | 324 | 0001 | 031 |
| 0002 | ZQD | 327 | 1328b | 326 |
| 0004 | 1G2 | 324b | | 030, 420 |
| 0005 | ATA | | | |
| 0008 | 1M4 | | | 101 |
| 0011a | HE6 | | | |
| 0011b | 1G3 | | | 419 |
| 0012 | 1G4 | 647 | 0025 | 048 |
| 0016 | ZUJ | 070 | 0024, 1344 | 164 |
| 0017 | ZUH | 070 | 0024, 1344 | 164 |
| 0019 | YSA | 345 | 0091, 1310 | 135 |
| 0021 | YSB | 346 | 1310a | 504 |
| 0023 | 1G1 | 324 | 0079 | 029 |
| 0024 | 1M4 | 600 | 0080 | 101 |
| 0025 | AA1 | 322 | 0081 | 028 |
| 0028 | ZH1 | | | |
| 0029 | ZX1 | | | |
| 0036 | AMC | 669 | | 042 |
| 0041 | AMC | 075 | 0131 | 224 |
| 0042 | 1G8 | | | 302 |
| 0043 | AMC | | 0030 | 043 |
| 0044 | 33A | | | 418 |
| 0045 | 1G5 | | | |
| 0048 | 1G2 | | | |
| 0050 | 3M1 | | | 527 |
| 0053 | 3M3 | 616 | 0037 | 064 |
| 0057 | 3M6 | | | 425 |
| 0058 | 3M1 | 067 | 0021 | 061 |
| 0059 | 3M2 | 612 | 0072 | 059 |
| 0060abdef | 1B5 | 689 | 0058 | 068, 434 |
| 0060c | 32K | | | 073 |
| 0061 | 32D | | | 440 |
| 0064 | PT4 | 705 | 0041 | 071 |
| 0067 | 1SF | | | |
| 0068 | 3M7 | | | |
| 0069 | 33B | 714 | 0044 | 009 |
| 0070 | 32A | 666 | 0017 | 039 |
| 0073 | BM2 | 728 | 0044a | 044 |
| 0074 | 32A | 325 | 0075 | 069 |
| 0077 | BM2 | | | 458 |
| 0079 | 2G4 | | | |
| 0082 | 1SB | | | 470, 471 |
| 0083 | ZUG | | | |
| 0086 | 2S1 | 701 | 0077 | 066 |
| 0087 | 2G1 | 430 | 0082 | 065 |
| 0088 | 1M1 | | | 461? |
| 0089 | 3M4 | | | |
| 0095 | XG8 | 068 | 0022 | 109 |
| 0098 | ZS1 | | | 324 |
| 0100ab | 1B2 | | | |
| 0102 | 1B2 | | | |
| 0103a-f | 1B1 | | | |
| 0106 | 22F | | | 438 |
| 0108 | 2S4 | | | |
| 0109 | 1B9 | 066 | 0020 | 106 |
| 0110 | 1BA | 321 | 0032 | 105 |
| 0113 | 1B1 | | | |
| 0114 | XG4 | | 0083 | |
| 0115 | 1SA | 610 | 0006 | 078 |
| 0116 | 1S2 | 606 | 0062 | 035 |
| 0117 | 1S1 | | | 422 |
| 0118 | ACC | | | |
| 0120 | 1S3 | 643 | 0087 | 027 |
| 0121 | 1M2 | | | |
| 0122 | 2S6 | 638a | 0038, 0040 | 036, 436 |
| 0124 | 32J | | 0045 | 023 |
| 0126 | 32M | 638b | 0074 | 037 |
| 0128 | 32P | | | |
| 0130 | 2S2 | 609 | 0076 | 052, 437 |
| 0134 | ZD2 | | | |

| T# | Code | Gates | Zimm | Knor |
|---|---|---|---|---|
| 0135acd | 32G | | | 008 |
| 0136 | 33F | 757 | 0065, 0078 | 018 |
| 0142bc | 33K | | | |
| 0143 | 33G | 752 | | 010 |
| 0145def | ZUH | | | |
| 0148 | 1B7 | | | 330 |
| 0149ef | 22B | | | 083 |
| 0150a | 1B1 | | | |
| 0150bc | 1B8 | | | 533 |
| 0151 | 3M9 | | | |
| 0152 | SSD | 003b | 0013 | 082 |
| 0153 | ZQ9 | 303 | 1353 | 367 |
| 0154 | HE1 | | | |
| 0155a | 1SJ | 712b | 0051 | 327, 328 |
| 0155e | MZF | | | |
| 0158 | YG4 | | | 450 |
| 0165abd | 2M4 | | | |
| 0168 | 2M1 | 013 | 0042 | 100 |
| 0170 | 2M2 | | | |
| 0173abc | ZQ4 | | 0070b | |
| 0173d | ZQ3 | | | |
| 0174 | 32B | | | 442 |
| 0175 | MB4 | | | 441 |
| 0176b | ZC6 | | | |
| 0177 | ZC5 | | | |
| 0178 | AMB | 751 | 0063 | 015; 016 |
| 0181 | ZU1 | 602 | 0060 | 034 |
| 0182 | ZV1 | | | |
| 0184 | SN3 | | | 427 |
| 0187 | ZE1 | | | |
| 0188 | 1SC | | | |
| 0191 | HE6 | | | 426 |
| 0192ab | ZY6 | | | |
| 0192c | 1G7 | | | |
| 0193 | ZH5 | | | 349 |
| 0197 | ZY8 | | | |
| 0198 | 1S3 | | | |
| 0200 | ZC5 | | | |
| 0203a | AA3 | | | 431 |
| 0204 | AA4 | | | 421, 445 |
| 0206 | AC1 | | | 446 |
| 0207 | ACN | 605 | 0026 | 057 |
| 0208 | SCP | | | |
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| 0220ab | MZR | | | |
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| 0221b | MZ6 | | | |
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| 0222 | MZ2 | | | |
| 0223 | HTD | | | |
| 0225 | ACE | | | |
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| 0238 | BP3 | 421, 620 | 0028 | 077 |
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| 0240b | SSF | | | |
| 0244 | 2S3 | | | |
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| 0249 | ZSJ | | | |
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| 0271 | 32E | | | |
| 0272 | ZVD | | | |
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| 0280 | BT1 | | | |
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| 0284 | 2M2 | | | |
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| 0294 | AV7 | | | 444 |
| 0297 | 22E | | | |
| 0299 | 2S7 | | | |
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| 0336 | 22G | | | |
| 0338 | XV4 | | | |
| 0348 | 3M5 | | | |
| 0351 | ZX4 | | | |
| 0353 | BT8 | | | |
| 0355 | ZX6 | | | |
| 0358 | HTB | | | |
| 0361 | MZM | | | |
| 0366 | 3M7 | | | |
| 0367 | 32T | | | |
| 0368 | 1C4 | | | |
| 0369 | AC4 | | | |
| 0370 | ZS4 | | | |
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| 0502 | XE3 | | | 187 |
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| 0504 | XH9 | 003 | 1323 | 153 |
| 0505 | ACL | | | |
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| 0510b | ZQD | 326 | 1328a | 353 |
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| 0512 | ZY7 | | | |
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| 0514 | ZZ5 | | | 520 |
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| 0518ab | 2M1 | | | 454 |

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| 0520 | XS3 | | | |
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| 0527 | XQ8 | 018 | 1338 | 167 |
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# Appendix 5. Conflated Signs in Thompson (1962)

**0054**

T534 + T53

**0055**

T280 + T178

**0101**

T32 + T115

**0141**

T687 + T687

**0176a**

T61 + T536

**0179**

T58 + T533

**0180a**

T683 + T534

**0199**

T58 + T181

**0246**

T136 + T126

**0247**

T136 + T126

**0286a**

TI + T86b.

**0302**

T130 + T178

**0532**

T515 + T528

**0551**

T664 + T281

**0562**

T561 + T299

**0581**

T580 + T582

**0585c**

T102 + T585a

**0624a**

T624b + T583

**0626**

T626 + T281

**0629**

T683 + T628

**0687b**

T687a + T582

**0744b**

T744a + T582

**0756c**

T568 + T756

**0756d**

T528 + T756

**0758c**

T526 + T758b

**0762**

T751 + T764

**0818**

T653 + T568

**0847**

T501 + T2

**0848**

T158 + T644

**0850**

T95 + T281

**1028a**

T1011 + ?

**1041**

T679 + T1042

# Glossary

*acrophony* — the process of deriving syllabic values by using only the beginning of the word for the image depicted by the sign. In the Maya script this is always the first consonant and vowel (e.g., **ka** from **kay* 'fish').

*affix* — a sign that is attached to another sign.

*allograph* — a variant of a sign (i.e., one that has an equivalent logographic or syllabic value).

*allophone* — a nonsignificant variant of a single phoneme (i.e., *r* and *l* in a language that has only one liquid consonant).

*b'ak'tun* — a period of 400 tuns.

*bound morpheme* — a morpheme that cannot occur alone (e.g., *-ing* in English).

*calendrical sign* — a sign associated with a temporal period.

*cognate* — a word related to another by having been derived historically from a common proto-language.

*consonant-vowel (CV) combination* — the phonetic shape of syllabic signs in the Maya script (e.g., **le**).

*disharmony* — the spelling of a CVC root with two syllabic signs, the second of which does not have the same vowel as the root (e.g., **b'a-ki** for *b'ak* 'bone').

*elaboration personification* — adding facial features to a sign to make it appear to be the head of a person or animal.

*emblem glyph* — a title associated with a particular city, region, or lineage. Typically begins with *k'uhul* 'holy' and ends with *ajaw* 'lord, ruler'.

*free morpheme* — a morpheme that can occur alone; a word.

*GI, GII, GIII* — a series of deities first identified at the site of Palenque.

*glottal fricative* — the sound of *h* in English *hot.*

*glyger* — a reoccurring combination of signs that has the same value.

*glyph block* — a unit of the Maya script, composed of one to four or more signs, representing a syllable, a word, or a phrase.

*glyph C* — a glyph recording the number of lunations ended within a repeating cycle of six lunations.

*glyph G1, G2, etc.* — a sequence of nine glyphs, used to record a nine day cycle, often associated with the Aztec "nine lords of the night."

*glyph X* — a series of six signs (and their variants) that names a sequence of six lunations.

*glyph Y* — a sign that records a seven-day cycle.

*grapheme* — the minimal functional unit of a script.

*grapholect* — a customary manner of writing associated with a particular region or period.

*haab'* — literally 'year'; in Maya studies it refers to a year of 365 days, but it was used by the ancient Maya for periods of 365 or 360 days.

| | |
|---|---|
| *haab' patron* | a sign appearing in an initial series introductory glyph that varies according to the twenty-day month of the date recorded (e.g., the patron of Yax is the Venus sign). |
| *kalab'tun* | a period of 160,000 tuns. |
| *k'atun* | a period of 20 tuns. |
| *k'inchiltun* | a period of 3,200,000 tuns. |
| *lexical inventory* | a word list. |
| *liquid* | the sounds *r* and *l* and their variants. |
| *logograph* | a sign that represents an entire word. |
| *logo-syllabic script* | a mixed script that has both logographic and syllabic signs. |
| *long count* | the count of days from the beginning of the current era, recorded in a modified vigesimal format. |
| *morpheme* | a word or a part of a word that has a specific meaning (e.g., *dog* or *–ness* in English). |
| *morphology* | the study of word formation. |
| *phoneme* | a distinctive sound in a language (e.g., *l* and *r* are distinctive sounds in English). |
| *phoneticism* | the representation of speech sounds divorced from semantic content in a system of visual communication. |
| *phonetics* | the study of the sounds of language. |
| *phonology* | the study of the sound systems of languages. |
| *piktun* | a period of 8,000 tuns. |
| *proto-Ch'olan, etc.* | a proto-language is the original language from which a related group of languages descended. |
| *rebus* | the use of the image of an object for a similar-sounding word (e.g., a drawing of a bee for the word *be*). |
| *subgraphemic* | refers to a visual element smaller than a grapheme. |
| *substitution personification* | the substitution of the head or figure of a person or animal not visually related to the original sign. |
| *suffix* | a morpheme added to the end of a word. |
| *syllabic sign* | a phonetic sign that represents a syllable. |
| *synharmony* | the spelling of a CVC root with two syllabic signs, the second of which has the same vowel as the root (e.g., **b'a-ka** for *b'ak* 'bone'). |
| *tun* | a period of 360 days. |
| *velar fricative* | an *h*-like sound with a velar constriction, similar to *j* in Spanish *Juan*. |

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BVE 0240a
HB1 0569
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HB2 —
HB3 —
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PCB —
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ZZB —
ZZC —
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004 IV
005 V
006 VI
007 0855
009 IX
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1G2 0004
1G2 0048
1G2 —
1G3 0011b
1G4 0012
1G5 0045
1G5 0266a
1G6 —
1G7 0192c
1G8 0042

| 1G8 | 1M1 | 1M2 | 1M2 | 1M3 | 1M4 | 1M4 | 1M5 | 1S1 |
|---|---|---|---|---|---|---|---|---|
| — | 0088 | 0121 | 0617 | — | 0024 | 0008 | 0245de | 0117 |

| 1S2 | 1S2 | 1S3 | 1S3 | 1S6 | 1S9 | 1SA | 1SB | 1SC |
|---|---|---|---|---|---|---|---|---|
| 0116 | 1019 | 0120 | 0198 | — | — | 0115 | 0082 | 0188 |

| 1SC | 1SE | 1SF | 1SH | 1SJ | 22A | 22B | 22B | 22C |
|---|---|---|---|---|---|---|---|---|
| — | — | 0067 | — | 0155a | — | 0604 | 0149ef | — |

| 22D | 22E | 22F | 22F | 22F | 22F | 22G | 2G1 | 2G1 |
|---|---|---|---|---|---|---|---|---|
| — | 0297 | 0106 | 0592 | — | 0263 | 0336 | 0087 | — |

| 2G2 | 2G2 | 2G2 | 2G3 | 2G4 | 2G4 | 2M1 | 2M1 | 2M2 |
|---|---|---|---|---|---|---|---|---|
| — | 0603 | 0634 | — | 0079 | — | 0168 | 0518ab | 0170 |

| 2M2 | 2M3 | 2M4 | 2M6 | 2M7 | 2M8 | 2S1 | 2S1 | 2S1 |
|---|---|---|---|---|---|---|---|---|
| 0284 | — | 0165abd | — | 0333 | — | 0086 | — | 0647 |

| 2S2 | 2S2 | 2S3 | 2S3 | 2S4 | 2S5 | 2S6 | 2S6 | 2S6 |
|---|---|---|---|---|---|---|---|---|
| 0130 | 0335 | 0244 | — | 0108 | — | 0122 | — | 1035 |

| 2S7 | 32A | 32A | 32A | 32B | 32C | 32D | 32E | 32E |
|---|---|---|---|---|---|---|---|---|
| 0299 | 0074 | 0815 | 0070 | 0174 | — | 0061 | 0271 | — |

**32F** —

**32G** 0135acd

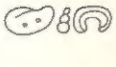
**32J** 0124

**32K** 0060c

**32K** —

**32K** —

**32M** 0126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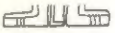
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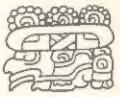
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**33D** —

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**33F** 0136

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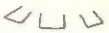
**33G** 0143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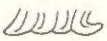
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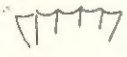
**34B** 0291c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**3M1** 0050

**3M2** 0059

**3M2** —

**3M3** 0053

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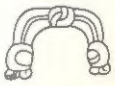
**3M9** 0282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**3MA** —